# California Environmental Health Indicators


Gray Davis, Governor
State of California

Grantland Johnson, Secretary
Health and Human Services Agency

Diana M. Bontá, R.N., Dr.P.H., Director
Department of Health Services


California
Department of
Health Services

**California Department of Health Services**
**Environmental Health Investigations Branch**

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# Contents

## Acknowledgements

This report was produced by the Environmental Health Investigations Branch of the California Department of Health Services. The authors were Paul English, Ph.D.; Robert Gunier, M.P.H.; Richard Kreutzer, M.D.; Diana Lee, M.P.H.; Robert McLaughlin, M.A.; Arti Parikh-Patel, M.P.H.; Julie Von Behren, M.P.H.; Emily Wersinger, M.P.H.; and Yan Yuan, M.A. Editing and graphic design support were provided by David Epstein, M.A., and Lauren Wohl-Sanchez, M.F.A., respectively. Ceciley Wilder prepared the manuscript.

# Introduction

California is a large state with a diverse population, physical environment, and economy. If California was a country, it would have the sixth largest economy on Earth. As the state's population has grown and economic activity has accelerated, many of its environments seem more frail and damaged. Consequently, the question arises whether environmental damage will harm people's health and prosperity. In addition, will efforts to meet our population's current needs compromise future generations' abilities to meet their needs? In other words, are current activities sustainable?

The government of California is a complex organization with many responsibilities including steering the state's economy and protecting human health and the environment. These responsibilities are translated into activities and programs that are departmentalized and specialized. An important question is whether a government organized this way can retain a comprehensive view (including health, welfare and environmental quality for future generations) and appropriately manage all of the state's complexity.

The answers to the questions above depend, in part, on the people of California who determine their government representatives and the issues of greatest importance. Organizing high quality information and distributing it to residents of California becomes critically important to this process. The California Department of Health Services offers this report on environmental health indicators to the people of California with the hope that it will help them in:

1. assessing current environmental health conditions of our state;
2. observing trends in conditions that help forecast the future;
3. considering policy options to achieve our goals;
4. identifying areas requiring attention and research; and
5. understanding data that are available and its limitations.

Each issue of California Environmental Health Indicators will contain information on a set of core indicators. This will allow for comparisons over time. Future issues also may include a feature section that discusses other indicators or elaborates further on core indicators. Possible featured indicators are transportation choices; air quality and respiratory health; urban and agricultural land use planning and implications for environmental health; the health implications of drinking water quality; emerging environmental health issues at the California/Mexico border; health implications of global warming for California; forest fires and human health; and indoor air quality.

Since this is the first issue, the feature section defines environmental health indicators and explains our criteria for selecting certain indicators. In addition, a description is provided of how information about the core indicators is presented in this report.

One issue that requires mention is the linkage between environment and health. Many organizations, such as the World Health Organization, the United States Environmental Protection Agency, and other states, have attempted to identify specific environmental health indicators, that is, indicators with clearly demonstrated links between specific envi-

ronmental dimensions and specific disease outcomes. This has proven to be very difficult since the association between the environment and health often is complex and poorly understood. We view this problem as a legitimate challenge to those in the environmental health sciences. However, we have not let this scientific challenge prevent us from providing a look at the state's environmental health status using indicators that we think reflect upon those things Californians value most.

# Environmental Health Indicators for California: Definitions and Criteria

## What Is "Environmental Health"?

The term "environmental health" is commonly used to describe the subdiscipline of public health that is concerned with effects of contaminants in the environment on human health. These contaminants include chemical (e.g., air pollution), physical (e.g., ionizing radiation), and biological (e.g., viruses) agents. However, we accept the definition used by the World Health Organization (WHO) which extends the term environmental health to include the effects on human health from the broad physical and social environment that includes "housing, urban development, land-use and transportation, industry, and agriculture."[1]

## What Is An "Environmental Health Indicator"?

There have been several previous attempts by governmental and non-governmental organizations to develop indicators of environmental health. The United States Department of Health and Human services established the Healthy People 2010 objectives for environmental health.[2] These were developed around six major areas relating to the environment: outdoor air quality, water quality, toxics and waste, healthy homes and healthy communities, infrastructure and surveillance, and global environmental health. Within each of these target areas specific, quantifiable objectives were set.

The WHO has developed environmental health indicators that are modeled after their DPSEEA (Driving force, Pressure, State, Exposure, Effect, Action) framework that describes a feedback cycle of the interplay between environment and health.[3] The model proposes that there are driving forces (e.g., population growth, technological development, etc.) that generate pressures on the environment (e.g., environmental exploitation such as mining, manufacturing, etc.), which in turn lead to changes in the state of the environment, expressed in terms of variables like availability of natural resources and frequency of natural hazards. When people are exposed to these hazards through the typical routes such as air and water, adverse health effects may occur, which lead to actions to modify the driving forces that start the problem. This framework also specifies various criteria for what is a good indicator. This model says that an indicator must provide a meaningful summary of the conditions of interest, be scientifically sound, be cost-effective to measure, and be sensitive, as well as specific, to real changes in the conditions they measure.

The California Comparative Risk Project took the approach of ranking environmental health factors based on the relative amount of risk each posed to human health.[4] Among the high-ranked risks were exposure to environmental tobacco smoke, ozone, and radon. Medium-ranked risks included carbon monoxide and lead. Low ranked-risks included radionuclides, sulfur dioxide, and nitrogen dioxide. One problem with this approach was that some risks could not be ranked due to a lack of data.

The World Resources Institute (WRI) used a similar strategy to ranking both developing and developed countries with respect to environmental health.[5] WRI used two variables for ranking developed countries: exposure to polluted ambient air and exposure to air polluted with lead from gasoline. A numerical value was used to rank each developed country from lowest to highest and these values were then divided into three categories of exposure: high, medium and low. One drawback of this approach is that the division into the three broad categories was somewhat arbitrary; it is possible that there may be little difference between two countries close to the cutoff points in different categories.

New Jersey Future, a non-profit advocacy group, incorporated environmental health indicators in a broader way into their report on the future of New Jersey.[6] The philosophy behind their report "Living With the Future in Mind: Goals and Indicators for New Jersey's Quality of Life," is that economic, social and environmental factors all interact to determine the health of a population. Along with discussions of drinking water quality, air pollution, and greenhouse gas releases, this report contains data on economic indicators such as income, unemployment and productivity, as well as social factors, such as educational quality, housing, and transportation.

The U.S.-Mexico Border XXI Program of the United States Environmental Protection Agency (USEPA) used the Organization for Economic Cooperation and Development framework for defining and organizing indicators.[7] This model divides environmental indicators into three categories: pressure, state, and response indicators. Pressure indicators are measures of pressure on the environment caused by human activities. An example of a pressure indicator is emissions of pollutants. State indicators refer to measures of the quality of the environment, the quantity of natural resources, and how these impact human health. A state indicator that is being measured is the number of border area accidents per year. Response indicators are measures of the success of strategies implemented by society to mitigate environmental degradation. One response indicator that this project is trying to assess is the number of organizations capable of responding to chemical emergencies along the border, by state and locality or municipality.

The Council of State and Territorial Epidemiologists, in collaboration with the Centers for Disease Control and Prevention, the Agency for Toxic Substances and Disease Registry, and the USEPA, has developed a set of specific environmental public health indicators to aid federal, state, and local health agencies in their surveillance of adverse health outcomes related to environmental factors.[8] Another underlying goal of the project was to improve data collection systems by identifying gaps in knowledge. The group defined an environmental public health indicator as one that:

> "provides information about a population's health status with respect to environmental factors. As such it can measure health or a factor associated with health…in a specific population."

Indicators were divided into three broad areas of environmental health: water, air, and chemical/physical agents. Within each area, indicators were identified as a hazard, exposure, intervention, or health effect indicator. The indicators were further subclassified into core indicators (indicators for which information is readily available at the state level)

and optional indicators (indicators that states can choose to track or not track based on relevance, data availability, resources, etc.) The project defined an ideal indicator as one that can be measured, can be monitored over time, has a linkage between environment and health, is tied to public health objectives, and relates to existing standards, among other attributes.

Finally, USEPA's Office of Children's Health Protection has recently issued a report that summarized trends in the occurrence of environmental factors that are thought to affect the health of children.[9] The purposes of this report were to provide a tool for policymakers and to stimulate discussion on how to improve environmental data collection at the federal level. This report provides information on trends in both environmental contaminant levels and childhood disease occurrence.

## Defining Environmental Health Indicators for California

This previous work has guided us in developing our definitions and criteria for selecting indicators. There has been no previous attempt to develop a list and obtain data on specific environmental health indicators for California. Using the broad definition of environmental health as defined by the WHO above, we have decided that indicators of environmental health should include: (1) states of human health that are caused by, or are associated with environmental exposures; (2) measures of environmental quality that have the potential to affect human health; and (3) sociodemographic measures that place pressure on the environment, or increase the possibility of exposure in vulnerable populations. Indicators that we will describe here do not necessarily represent a direct relationship between an exposure in the environment and disease, but will rather illustrate a trend in health, environmental quality or sociodemographics, which is important for monitoring the overall health of the population.

Environmental contaminants with a sufficient dose affect health via existing pathways of food, air, or water, with entry into the body mediated by a complex interplay of genetic and social factors. For example, the number of children in a population hospitalized with severe asthma is influenced by an unknown combination of environmental exposures (such as animal dander, dust mites, and air pollution) and access to health care. The number of babies in a population born too small (low birth weight) or too soon (premature) is a health indicator that is determined by a multiplicity of factors such as access to and quality of health care, drug use during pregnancy, and environmental exposures (e.g., tobacco smoke). Up to 40% of all deaths worldwide have been attributed to environmental exposures, such as tobacco use, water pollution, and land degradation.[10, 11]

## Criteria

We have established four criteria for selecting environmental health indicators. First, the indicator should be sensitive to changes in the environment that affect human health. Second, the indicator should be measurable. Third, data to compute the indicator should be available (complete) statewide to examine status and trends. Fourth, the indicator should be valid (it measures what it is supposed to measure), and accurate. In future issues,

## Table 1. Environmental Health Indicators for California

| Indicator | Healthy People 2010 | WHO-DPSEEA† | CSTE‡ (proposed) | Sensitive | Measurable | Available (complete) | Valid/ Accurate | Total |
|---|---|---|---|---|---|---|---|---|
| **Sociodemographic** | | | | | | | | |
| 1. Population Growth | | ✓ | | | * | * | * | *** |
| 2. Life Expectancy | | ✓ | | | * | * | * | *** |
| 3. Poverty | | ✓ | | | * | * | * | *** |
| **Air Quality** | | | | | | | | |
| 4. Exceedences of Ozone Standard | ✓ | ✓ | ✓ | * | * | * | * | **** |
| 5. Toxic Air Emissions | ✓ | ✓ | ✓ | * | * | | * | *** |
| 6. Environmental Tobacco Smoke | ✓ | | ✓ | * | * | | | ** |
| **Pesticides** | | | | | | | | |
| 7. Pesticide Use | | | ✓ | | * | * | * | *** |
| **Water Quality** | | | | | | | | |
| 8. Drinking Water Quality | ✓ | ✓ | ✓ | * | * | * | * | **** |
| 9. Recreational Water Quality | ✓ | | ✓ | * | * | | * | *** |
| **Waste/Toxics** | | | | | | | | |
| 10. Hazardous Waste Sites | ✓ | | ✓ | | * | * | * | *** |
| 11. Solid Waste | ✓ | ✓ | ✓ | * | * | | * | *** |
| **Health** | | | | | | | | |
| 12. Cancer and the Environment | ✓ | | | | * | * | * | *** |
| 13. Childhood Asthma | ✓ | ✓ | ✓ | | * | | * | ** |
| 14. Childhood Lead Poisoning | ✓ | ✓ | ✓ | * | * | | | ** |
| 15. Low Birth Weight | ✓ | | | | * | * | * | *** |
| 16. Infant Mortality | ✓ | ✓ | | | * | * | * | *** |
| **California/Baja California Border Region** | | | | | | | | |
| 17. Air Quality | | | | * | * | * | * | **** |
| 18. Rate of Diarrheal Morbidity | | | | | * | | * | ** |

✓ Indicator present
* Indicator meets report criterion

† World Health Organization – DPSEEA framework
‡ Council of State and Territorial Epidemiologists

we hope also to use input from communities as part of the selection process to insure that the indicators we select are responsive to community concerns.

This report includes 18 environmental health indicators. Most of these do not satisfy the above criteria completely (see Table 1). For example, we have selected some indicators for which data are not completely available but are important indicators of environmental health. Since the California/Baja California border is an area of rapid environmental and demographic change, we have also included two indicators of environmental health for this special region.

## Presentation of Indicator Information

This report contains individual sections for each environmental health indicator. Generally, the sections are divided into six parts: definition, formula, significance, data characteristics, data limitations, and additional information.

Basic statistical data are presented. Sources of these data are located in each section. A pertinent Healthy People 2010 goal can be found in most sections. Nationwide data are included for certain indicators. The additional information part of each section indicates sources that can be consulted for further pertinent information and how they can be contacted.

## Sources of Further Information on Previous Models of Environmental Health Indicators

**Healthy People 2010**
http://www.health.gov/healthypeople/
Office of Disease Prevention and Health Promotion
United States Department of Health and Human Services
200 Independence Avenue, SW, Room 738G
Washington, DC 20201
(202) 205-2317

**World Health Organization/DPSEEA Model**
http://www.northampton.ac.uk/ncr/who/

**World Resources Institute**
http://www.wri.org/wr-98-99/001-bx02.htm
10 G Street, NE, Suite 800
Washington, DC 20002
(202) 729-7600

**New Jersey Future**
http://www.njfuture.org/
114 West State Street
Trenton, NJ 08608
(609) 393-0008

**United States-Mexico Border Environmental Indicators 1997**
http://www.epa.gov/usmexicoborder/indica97/index.htm
United States Environmental Protection Agency Region 9
75 Hawthorne Street
San Francisco, CA 94105
(415) 947-8021

**United States Environmental Protection Agency**
**Office of Children's Health Protection**
http://www.epa.gov/children/indicators/about_report.html
1200 Pennsylvania Avenue, NW
Mail Code 1107A
Room 2512 Ariel Rios North
Washington, DC 20004
(202) 564-2188

## References

1. World Health Organization. Indicators for policy and decision making in environmental health (draft). Geneva, Switzerland:July 1997.
2. United States Department of Health and Human Services. Healthy People 2010. Washington, DC:January 2000.
3. World Health Organization. Environmental health indicators: framework and methodologies. Geneva, Switzerland:1999.
4. California Comparative Risk Project. Toward the 21st Century: planning for the protection of California's environment. Final Report submitted to the California Environmental Protection Agency. 1994.
5. World Resources Institute. 1998–1999 world resources. Environmental change and human health. 1998.
6. New Jersey Future. Living with the future in mind. Goals and indicators of New Jersey's quality of life. 1999 Sustainable State Project Report. New Jersey:1999.
7. United States Environmental Protection Agency. United States-Mexico border environmental indicators 1997. Washington, DC:1997.
8. Council of State and Territorial Epidemiologists, Centers for Disease Control and Prevention, Agency for Toxic Substances and Disease Registry, United States Environmental Protection Agency. Environmental public health indicators (draft). January 2001.
9. United States Environmental Protection Agency. America's children and the environment: a first view of available measures. Washington, DC:2001.
10. Pimetel D, Tort M, D'Anna L, et al. Ecology of increasing disease: population growth and environmental degradation. Bioscience 1998;48:817–26.
11. Smith K. How Much Global Ill Health is Attributable to Environmental Factors? Epidemiology 1999;10(5):573-84.

# Population Growth

## Definition

Average annual rate (percent) of change of population size during a specified time period.

## Formula

Rate = 100 × $((P_{t+n} - P_t) \div P_t) \div N$, where $P_t$ is the population size at time t and n is the length of a time period.

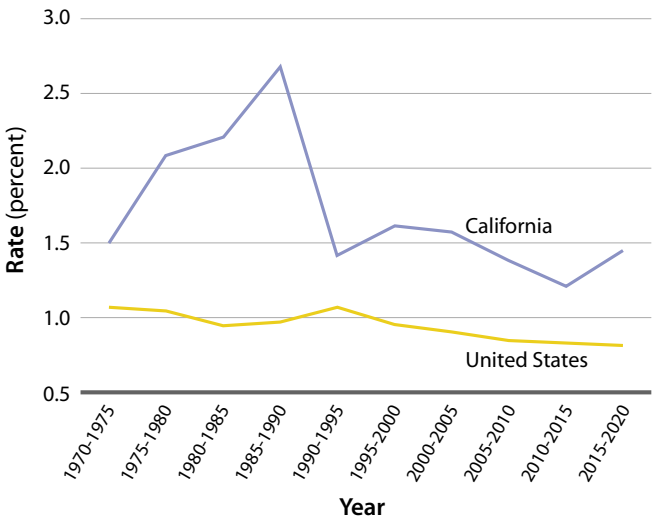
## Significance

The environmental and health consequences of human activity generally increase with the growth of the population. Population growth creates larger demands on or conflicts over our resources, infrastructure, and services. In addition, population growth is associated with many critical environmental problems such as water pollution, destruction of fertile soil and forests, production of waste, and the burden on cities, with possible consequences for the public's health, safety, and welfare.

## Data Characteristics

Rate of population growth is a measure of how fast a population is growing. The California Department of Finance releases state and county population estimates annually. Based on these estimates, the average annual rate of population growth during a specified period can be calculated. The nation's most populous state, California, is growing faster than the United States as a whole (Figure 1). However, after accelerating for two decades, the annual rate of population growth in California has declined since hitting a peak in the late 1980s, dropping from a high of 2.7% to an estimated 1.6%. However, a growth rate of 1.6% translates into an increase of 500,000 in population in one year.

**Figure 1. Rate of Population Growth, California and the United States, 1970-2020.**

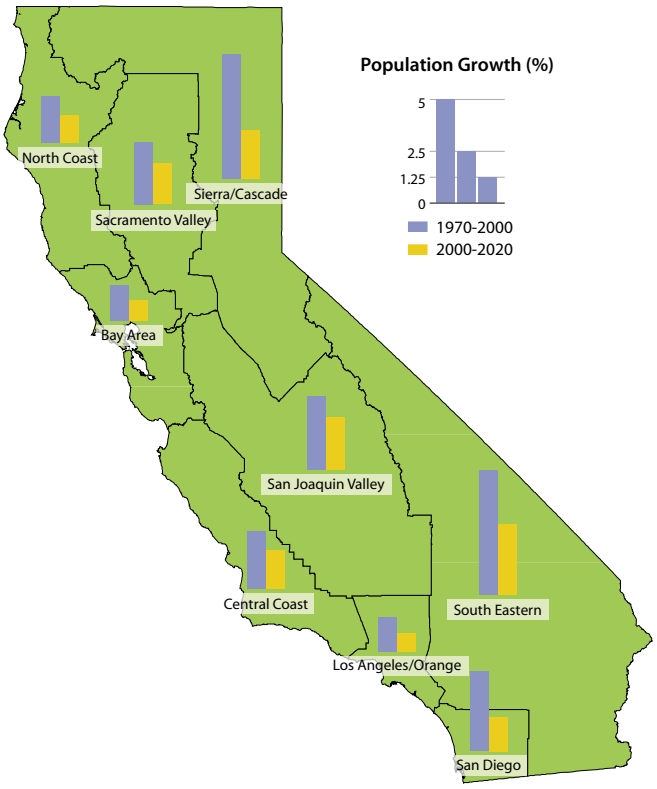



Source: California Department of Finance and United States Census Bureau.

Monitoring the rate of population growth at a regional or local level provides an important perspective on identifying areas where this growth may threaten the environment and allows for region-specific health planning and policy analysis. Three-quarters of

Californians live in three major regions: the Bay Area, Los Angeles/Orange and San Diego. But the fastest growth rates have been in the Sierra Cascade and the South Eastern regions (Figure 2).

**Figure 2. Percent Change in Population Growth, by Region, 1970-2000, and 2000-2020.**




Source: California Department of Finance.

## Data Limitations

Although population growth can increase environmental degradation, it is not always directly related to environmental stress and increased health risks. For example, environmental improvements in California during the 1980s and 1990s — including decreasing levels of ambient air pollutants such as ozone, carbon monoxide, and toxic air contaminants, have been made while the population increased. Population growth interacts with consumption patterns, technologies, political and economic structures, and other factors to influence environmental change and health, and this interaction makes it impossible to determine precisely how changes in the rate of population growth affect specific environmental problems.

## Additional Information

**California Department of Finance**
http://www.dof.ca.gov/HTML/DEMOGRAP/Druhpar.htm
915 L Street
Sacramento, CA 95814
(916) 323-4086

**United States Census Bureau**
http://eire.census.gov/popest/estimates.php
Washington, DC 20233
(301) 457-2422

**RAND California**
http://www.ca.rand.org/stats/popdemo/popdemo.html
1700 Main Street
P.O. Box 2138
Santa Monica, CA 90407-2138
(310) 393-0411

**Negative Population Growth, Inc.**
http://www.npg.org/states/state_index.htm
1717 Massachusetts Avenue, NW, Suite 101
Washington, DC 20036
(202) 667-8950

# Life Expectancy

## Definition

The average length of life of a newborn matching currently recorded age-specific mortality rates throughout life.

## Formula

Life expectancy at birth is derived from a life table, which is a fairly complicated statistical device. It is important to interpret life expectancy correctly. A life expectancy of 81 years for California women in 1998 does not mean that the average age at death in 1998 for women was 81. It means if all the females born in California in 1998 had the same risks of dying throughout their lives as those indicated by the age-specific mortality rates in 1998, then their average age at death would be 81.

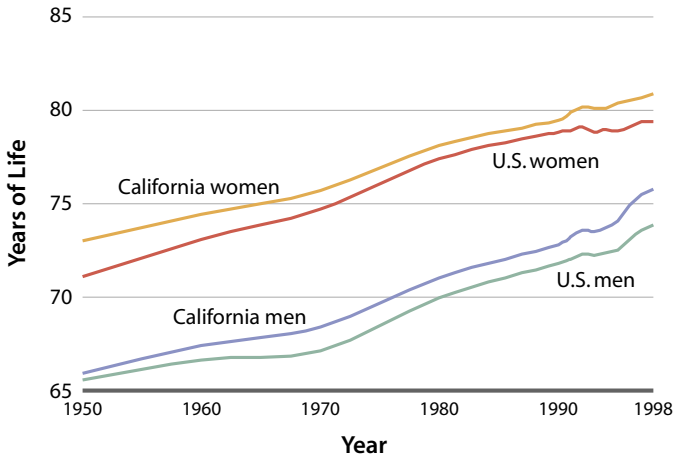
## Significance

Life expectancy is an important environmental health indicator. On the one hand, environmental conditions such as water and air quality, food supply and safety, housing, nutrition, and sanitation can influence how long people will live. On the other hand, increased life expectancy has also raised new challenges concerning environmental health issues, such as how to curb increased demand for energy and other natural resources as people live longer, how to maintain a supply of clean water and air, how to provide proper nutrition, sanitation and housing in the face of a growing population, and how to meet the population's increasing needs for health care services in terms of quality as well as quantity.

## Data Characteristics

The California Department of Health Services, Center for Health Statistics, produces state life expectancy data annually. In the past few decades, life expectancy at birth has steadily increased both in the United States and California. Compared with the nationwide population, Californians, regardless of gender, live slightly longer (Figure 1). From 1950 to 1998, life expectancy at birth for women in California climbed from 73.0 to 80.9 years. Life expectancy at birth for men during the same period increased from 65.9 to 75.8 years.

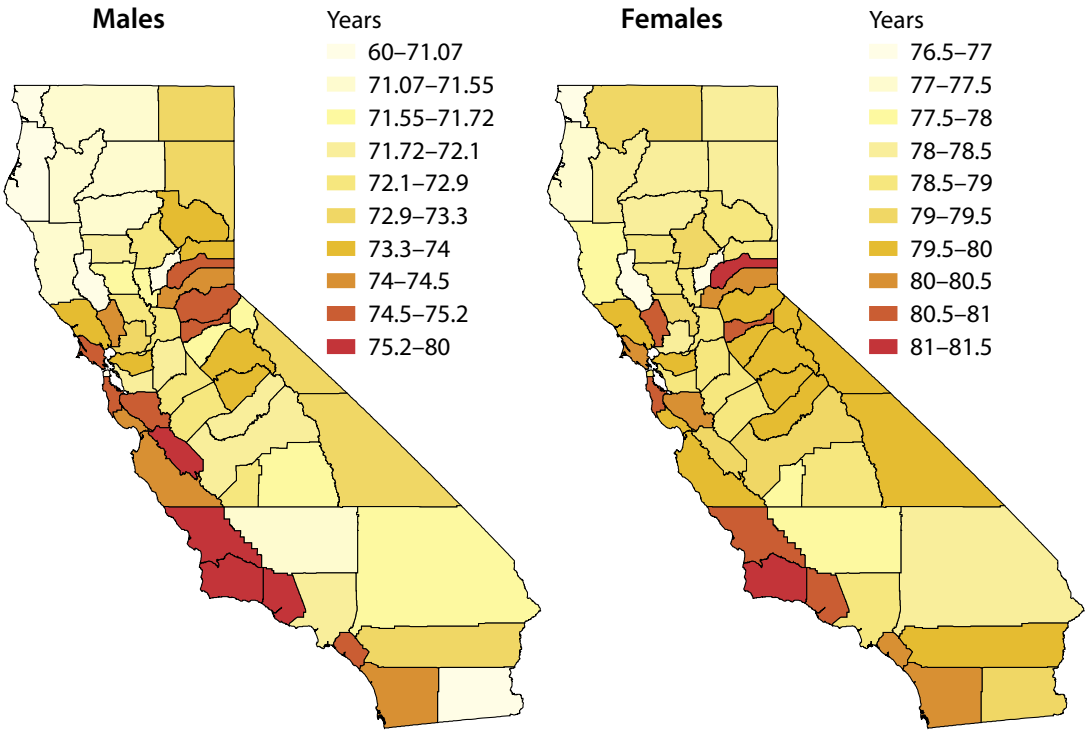
**Figure 1. Life Expectancy at Birth, by Sex, California and the United States, 1950-1998.**




Source: California Department of Health Services, Center for Health Statistics, and National Center for Health Statistics.

Life expectancy at birth showed significant variations in California counties both for men and women. In 1990, life expectancy at birth for men was lowest in San Francisco at 66.7 and highest in Santa Barbara at 75.5, and life expectancy at birth for women was lowest in Del Norte at 76.7 and highest in Santa Barbara at 81.1 (Figure 2).

**Figure 2. Life Expectancy, by California County, 1990.**




Source: California Department of Health Services, Center for Health Statistics.

## Data Limitations

Increased life expectancy may not always mean increased length of healthy life. Life expectancy measures quantity, not quality, of added years of life, which is one major limitation of its use as a measure of health status.

## Additional Information

**California Department of Health Services**
**Center for Health Statistics**
http://www.dhs.ca.gov/hisp/chs/chsindex.htm
304 S Street
Sacramento, CA 95814
(916) 445-6355

**Centers for Disease Control and Prevention**
**National Center for Health Statistics**
http://www.cdc.gov/nchs/products/pubs/pubd/lftbls/lftbls.htm
6525 Belcrest Road
Hyattsville, MD 20782-2003
(301) 458-4636

**United Nations**
http://www.worldpolicy.org/americas/econrights/maps-life.html

**Retire Web**
http://www.retireweb.com/death.html

**Berkeley Mortality Database**
http://www.demog.berkeley.edu/wilmoth/mortality/states.html

# Poverty

## Definition

Poverty rate is the percentage of the population living below the poverty thresholds (e.g., $17,463 for a family of four with two children under 18 years of age in 2000).

## Formula

$$\text{Rate} = 100 \times \frac{\text{number of persons below the poverty thresholds}}{\text{number of persons for whom poverty status is determined}}$$

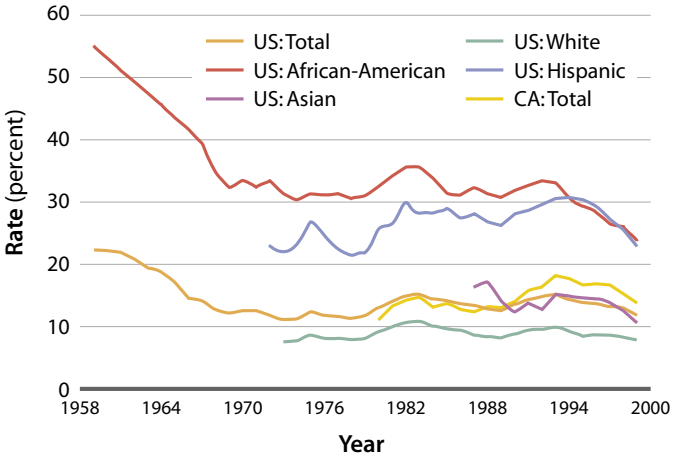
## Significance

Poverty is a standard measure of the economic and social well being of a population. Historically, in the United States, poverty has been associated with increased risk of exposure to environmental hazards and toxins, and increased risks to health due to lack of clean water, adequate sanitation, nutrition, and shelter. It has also been higher for African-Americans and other ethnic minority groups.

## Data Characteristics

The United States Census Bureau calculates two estimated poverty rates using different methodologies. The most commonly cited data are derived from income estimates measured by the Current Population Survey (CPS), an annual survey of about 50,000 households. The income estimates are compared with poverty thresholds that vary by family size and composition and are updated annually for inflation. If a family's total income is less than that family's threshold, then the family, and every individual in it, is considered in poverty. The Census Bureau also produces another data series named Small Area Estimates. These are not based on a survey, but are "model-based" estimates derived using administrative data such as tax returns and food stamp data. The Small Area Estimates are usually considered the most accurate for states and counties, but they are not as timely as the CPS-based estimates.

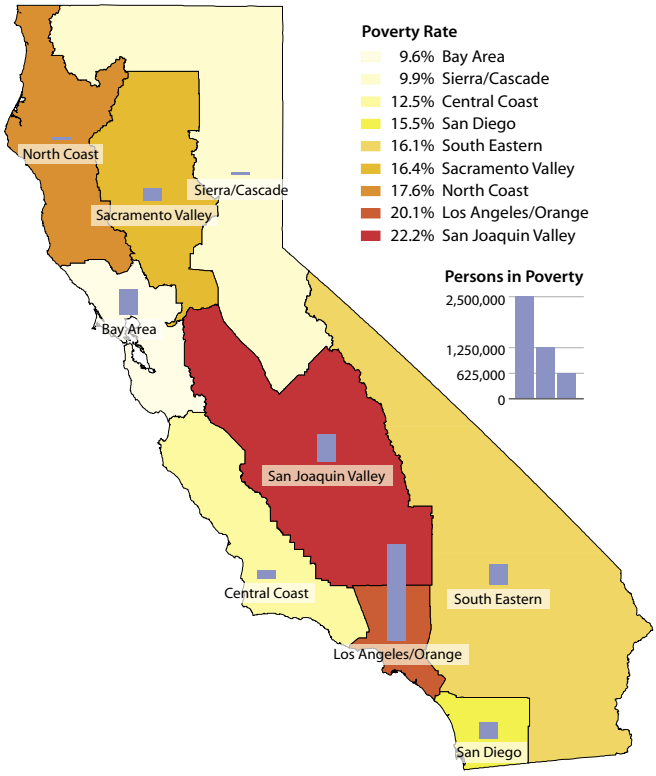
**Figure 1. Poverty Rate, by Race and Ethnicity, United States, 1959-1999, and for Total Population, California, 1980-1999.**




Note: Data for some subgroups are not available for earlier years.
Source: United States Census Bureau, Historical Poverty Data, Current Population Survey.

In California, poverty steadily declined in the second half of the 1990s, following a rise during the recession of the early 1990s (Figure 1). Despite this, California's poverty rate has remained above the national rate. Poverty is particularly high in the San Joaquin Valley, Sacramento Valley, Los Angeles/Orange and North Coast regions (Figure 2). In absolute terms, the largest numbers of persons below poverty are in Los Angeles/Orange.

**Figure 2. Distribution of Poverty, 1995.**




Source: United States Census Bureau, Small Area Estimates.

## Data Limitations

The income thresholds used by the Census Bureau do not take into account local variations in the cost of living. This may result in under-estimating poverty in high cost areas like the San Francisco Bay Area. Other limitations include the lack of timeliness of the Small Area Estimates and large error ranges in the CPS, especially for state data.

## Additional Information

**United States Census Bureau**
http://www.census.gov/hhes/www/poverty.html
Washington, DC 20233

**United States Department of Health and Human Services**
http://www.aspe.hhs.gov/poverty/poverty.htm
200 Independence Avenue, SW
Washington, DC 20201
(202) 619-0257
(877) 696-6775

**Center for Continuing Study of the California Economy**
http://www.irus.org/
610 University Avenue
Palo Alto, CA 94301
(650) 321-8550

**Institute for Research on Poverty**
http://www.ssc.wisc.edu/irp/
University of Wisconsin-Madison
1180 Observatory Drive
3412 Social Science Building
Madison, WI 53706-1393
(608) 262-6358

**Joint Center for Poverty Research**
http://www.jcpr.org/
Northwestern University Institute for Policy Research
2046 Sheridan Road
Evanston, IL 60208
(847) 491-4145

University of Chicago Harris Graduate School of Public Policy Studies
1155 East 60th Street
Chicago, IL 60637
(773) 702-0472

# Exceedences of Ozone Standard

## Definition

Number of days per year that the state ozone standard is exceeded.

## Formula

The maximum one-hour ozone concentration is regulated by state and federal laws, with the California standard of 0.09 parts per million (ppm) being more stringent than the federal standard of 0.12 ppm. The concentration of ozone in ambient air is monitored at many locations throughout California. The number of days that the state ozone standard was exceeded anywhere in California was summed.

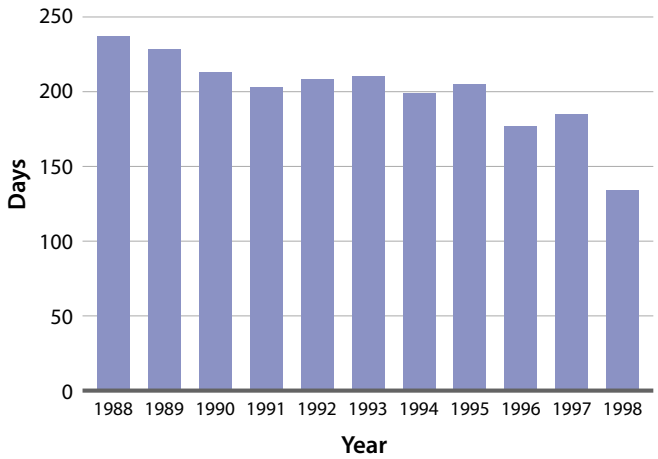
## Significance

Ozone is a secondary air pollutant formed by the reaction between hydrocarbons and nitrogen oxides in the presence of sunlight. Ground-level ozone is the main component of urban smog. It is a respiratory irritant that can exacerbate asthma and other respiratory diseases by damaging lung tissue. Weather conditions are important for ozone formation and hot summer days tend to produce the highest ozone concentrations. Due to the time required for ozone formation, peak concentrations can occur far away from the original pollutant emissions making ozone a regional environmental issue. Motor vehicles are the primary source of ozone forming pollutants, accounting for over 50% of emissions statewide.

## Data Characteristics

Information on ozone in the state is provided by the California Air Resources Board. The maximum one-hour ozone concentration has been decreasing in California over the past ten years from over 0.3 ppm to around 0.2 ppm. However, meeting the state ozone standard remains a problem. Figure I shows the number of days that the state ozone standard was exceeded each year from 1988 to 1998. The number of days has decreased from 237 in 1988 to 134 in 1998. Since the highest ozone concentrations often occur near the most populated areas of the state, the number of days exceeding the standard is a good surrogate for population exposures. In

**Figure 1. Number of Days the State Ozone Standard was Exceeded, California, 1988-1998.**

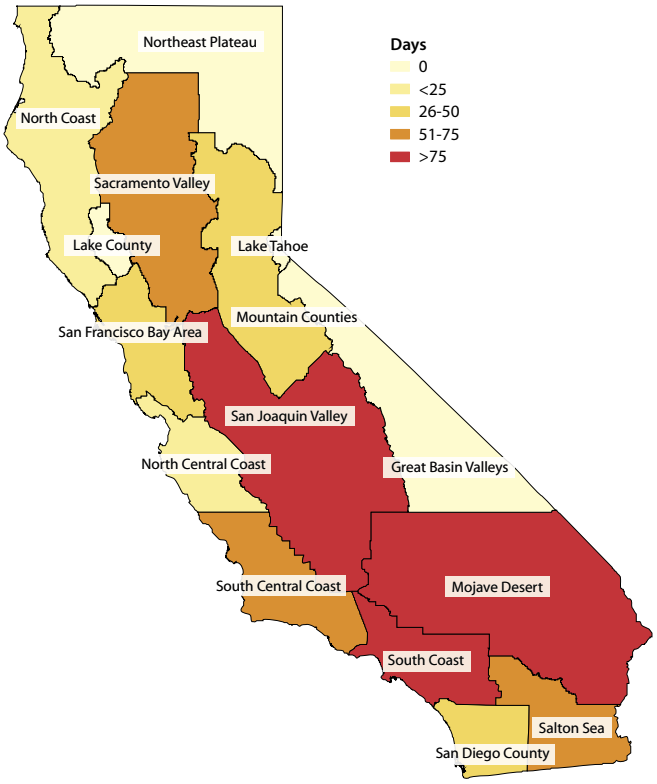



Source: California Air Resources Board.

1998, over 99% of the population in California lived in areas where the state ozone standard was exceeded. Figure 2 shows the number of days that the state standard was exceeded in 1998 by air basin. The South Coast air basin has by far the worst ozone problem, while the less populated northern and eastern parts of the state are mostly in compliance.

The Healthy People 2010 goal is to have no people exposed to air that exceeds the federal ozone standard. Although ozone pollution is improving in California, it is unlikely that the entire state will meet the target by 2010.

**Figure 2. Number of Days the State Ozone Standard was Exceeded, by Air Basin, 1998.**




Source: California Air Resources Board.

## Data Limitations

Ambient ozone concentrations may not accurately reflect individual level exposures. Air basins are large geographic areas that are likely to have a wide range of ozone concentrations at any time. The number of days exceeding the standard does not reflect the actual peak concentration or how many hours the concentration was elevated.

## Additional Information

**United States Environmental Protection Agency**
http://www.epa.gov/airs/airs.html

**California Air Resources Board**
http://www.arb.ca.gov/homepage.htm
1001 I Street
P.O. Box 2815
Sacramento, CA 95812-2815
(916) 322-2990

**Environmental Defense Scorecard**
http://www.scorecard.org/env-releases/cap/

# Toxic Air Emissions

## Definition

Toxic air emissions from industrial facilities.

## Formula

The Toxics Release Inventory (TRI) requires manufacturing facilities that meet certain minimum reporting thresholds to estimate their annual emissions of over 300 chemicals. Total annual pounds of air releases were summed for California.

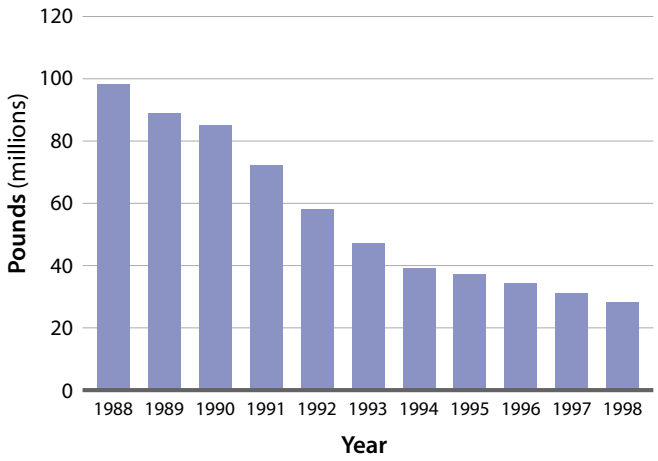
## Significance

Toxic air contaminants are compounds that have been shown to cause adverse health effects in occupational health or laboratory animal studies. The adverse health effects range from acute conditions like respiratory irritation to chronic diseases such as cancer.

## Data Characteristics

There are no state or federal standards regulating the concentration of toxic air contaminants and ambient monitoring is conducted at only 20 sites in California. Therefore, emissions estimates must be used to evaluate potential public health impacts. The TRI is a federal program that was created by the Emergency Planning and Community Right-to-Know Act of 1986. TRI data are collected and distributed to the public by the United States Environmental Protection Agency (USEPA).

**Figure 1. Toxics Release Inventory Air Emissions, California, 1988-1998.**




Source: United States Environmental Protection Agency.

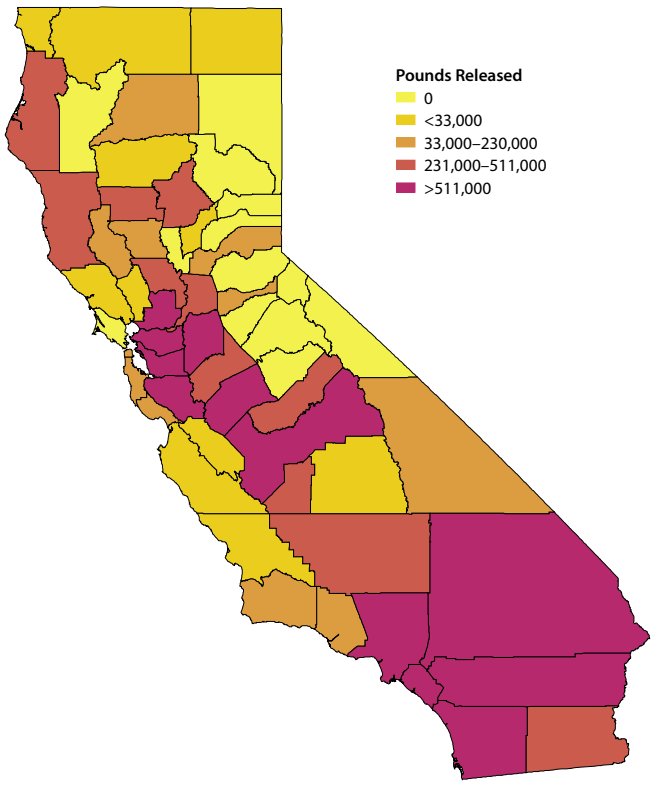
Figure 1 shows the annual pounds of air emissions by year in the state. There was a large drop in reported emissions from 98 million pounds in 1988 to 28 million pounds in 1998. There is some debate over whether this decrease was due to an actual reduction in emissions or changes in reporting practices. A Healthy People 2010 developmental objective is to reduce the amount of toxic pollutants released into the environment.

Figure 2 shows 1998 TRI air emissions in California by county. Los Angeles, Contra Costa and Orange Counties had the highest reported air emissions.

## Data Limitations

The TRI data represent only large industrial sources of toxic air emissions. Motor vehicles are the major source of toxic air emissions in California. The total pounds of air emissions also does not account for differences in the toxicity and environmental fate of individual compounds. More sophisticated modeling of exposure to toxic air contaminants has been conducted by USEPA's Cumulative Exposure Project.

**Figure 2. Toxic Release Inventory Air Emissions, by County, 1998.**




Source: United States Environmental Protection Agency.

## Additional Information

**United States Environmental Protection Agency**
http://www.epa.gov/triexplorer/

**California Air Resources Board**
http://www.arb.ca.gov/homepage.htm
1001 I Street
P.O. Box 2815
Sacramento, CA 95812-2815
(916) 322-2990

**Environmental Defense Scorecard**
http://www.scorecard.org/env-releases/us-map.tcl
http://www.scorecard.org/env-releases/hap/

# Environmental Tobacco Smoke

## Definition

Environmental Tobacco Smoke (ETS), also called secondhand smoke, is a mixture of the smoke given off by the burning end of a cigarette, pipe, or cigar and the smoke exhaled from the lungs of smokers.[1]

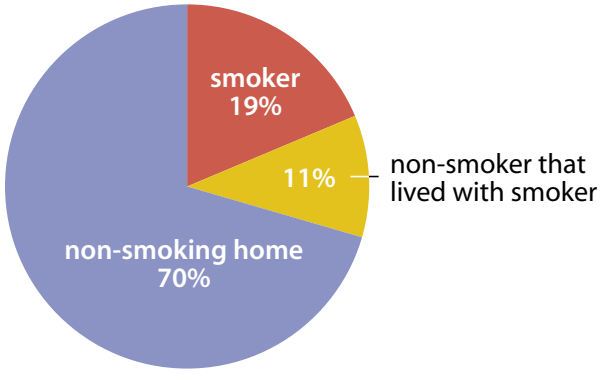
## Significance

Secondhand smoke has been classified by the United States Environmental Protection Agency as a known cause of cancer in humans (Group A carcinogen). Other health effects of ETS include eye, nose, and throat irritation and headaches. ETS may contribute to heart disease. In children, ETS increases the risk of lower respiratory tract infections, like bronchitis and pneumonia, and ear infections. ETS also increases the severity and frequency of asthma episodes and can lead to decreased lung function. ETS also causes low birth weight.

## Data Characteristics

One way that ETS exposure may occur is by living with a smoker. Data from an annual health survey conducted by the California Department of Health Services indicate that in 1999, 11% of adults in California were non-smokers who lived with smokers (Figure 1). Also, the survey indicates that 21% of California children under age six were exposed to ETS in 1999.

**Figure 1. Proportions of California Adults who Smoked, or Lived with Smokers, 1999.**




Source: California Department of Health Services, Behavioral Risk Factor Survey.

One Healthy People 2010 goal is to "reduce the proportion of non-smokers exposed to environmental tobacco smoke." The goal is measured by the proportion of non-smokers who have measurable levels of cotinine, a tobacco by-product, in their blood. National figures indicate 65% of non-smoking Americans age four or older have measurable levels in their blood.[2] The target rate is 45%. Data are not available for California.

## Data Limitations

Results from the health survey should be viewed cautiously. First, the data are self-reported. Second, not all smokers allow smoking in their homes.

## Additional Information

**Office of Environmental Health Hazard Assessment**
http://www.oehha.org/air/environmental_tobacco/
P.O. Box 4010
Sacramento, CA 95812-4010
(916) 324-7572

**American Lung Association**
http://www.lungusa.org/tobacco/secondhand_factsheet99.html
1740 Broadway
New York, NY 10019
(212) 315-8700

**Centers for Disease Control and Prevention**
**Tobacco Information and Prevention Source**
http://www.cdc.gov/tobacco/research_data/environmental/etsfact3.htm

**Public Health Institute**
**Survey Research Group**
http://www.surveyresearchgroup.com/clients.asp?ID=9
http://www.surveyresearchgroup.com/clients.asp?ID=10
1700 Tribute Road, Suite 100
Sacramento, CA 95815-4402
(916) 779-0338

## References

1. United States Environmental Protection Agency, Indoor Environments Division. Web site on secondhand smoke: www.epa.gov/iaq/asthma/triggers/shs.html.
2. United States Department of Health and Human Services. Healthy People 2010. Washington, DC:January 2000.

# Pesticide Use

## Definition

Total annual pounds of carcinogenic pesticides (possible and probable carcinogens as classified by the United States Environmental Protection Agency) applied agriculturally.

## Formula

Under California State law, all agricultural pesticide applicators are required to report pesticide use to the California Department of Pesticide Regulation. Total annual pounds were summed for carcinogenic pesticides applied to agricultural fields in California.

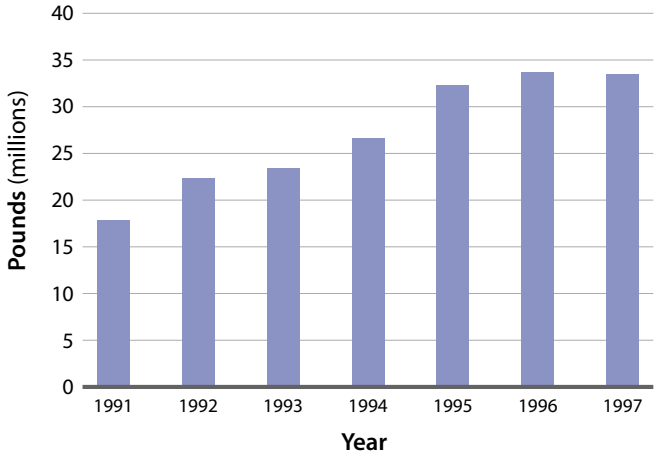
## Significance

Agricultural pesticide use is an important environmental health indicator because the introduction into the environment of increasing poundage of pesticides increases the likelihood of exposure through air, water, soil, and the food supply. Along with agricultural use, exposure may occur from indoor use in homes and in schools, in parks and other public locations, and from home garden pest control. California consistently ranks as the highest state for agricultural pesticide use in national surveys with 22% of all agricultural pesticide use nationwide in 1992.[1]

## Data Characteristics

In California, use of agricultural pesticides that have been classified as possible or probable human carcinogens has increased 87% from 1991–1997 (Figure 1). Agricultural pesticide use in California is concentrated mostly in the San Joaquin Valley region, with high use also in the Sacramento, Salinas, and Imperial Valleys (Figure 2).

**Figure 1. Agricultural Carcinogenic* Pesticide Use, California, 1991-1997.**

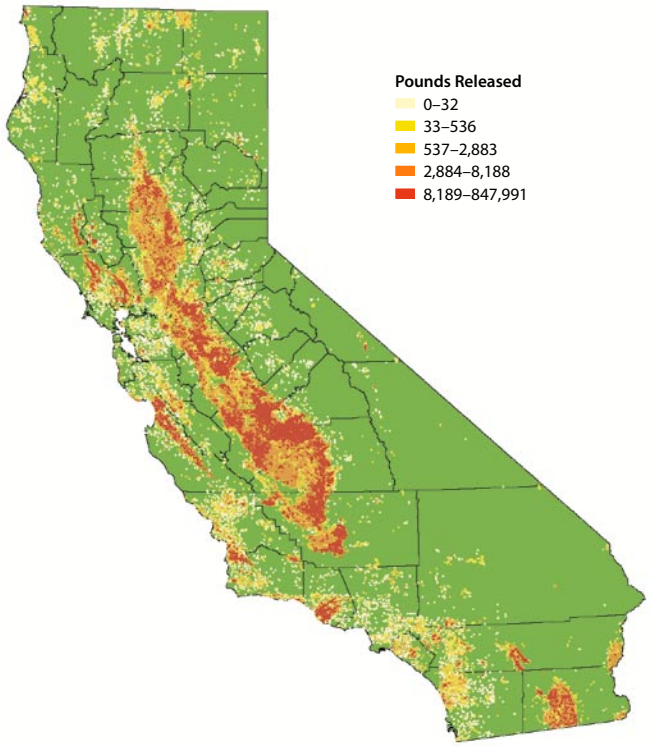



* Possible and probable human carcinogens (United States Environmental Protection Agency).
Source: California Department of Pesticide Regulation.

## Data Limitations

Although increasing pesticide use in agriculture may be correlated with increased human exposures, pesticide use does not tell us how many people have actually been exposed and the degree to which they have been exposed. The level or dose of exposure is also important in determining if human health effects will occur.

**Figure 2. Average Annual Pesticide Use, 1991–1994.**




Source: California Department of Pesticide Regulation.

## Additional Information

**California Department of Pesticide Regulation**
http://www.cdpr.ca.gov/
1001 I Street
P.O. Box 4015
Sacramento, CA 95812-4015
(916) 445-4300

**United States Environmental Protection Agency**
**Office of Pesticide Programs**
http://www.epa.gov/pesticides/
Ariel Rios Building
1200 Pennsylvania Avenue, NW
Washington, DC 20460
(703) 305-7090

**Californians for Pesticide Reform**
http://www.igc.org/cpr/
49 Powell Street, Suite 530
San Francisco, CA 94102
(415) 981-3939

## References

1. Aspelin AL. Pesticides industry sales and usage: 1992 and 1993 market estimates. Washington, DC:1994.

# Drinking Water Quality

## Definition

Percent of the population served by water systems who receive water that meets regulations of the Safe Drinking Water Act.

## Formula

$$\text{Percent} = 100 \times \frac{\text{number of people with access to safe water systems}}{\text{total population served by water systems}}$$

## Significance

Access to a safe drinking water supply is an important environmental health indicator. Contaminated drinking water is a major cause of illness and mortality resulting from exposures to infectious substances (such as bacteria or viruses), parasites (giardia, cryptosporidia), or chemical contaminants (such as lead or pesticides).

## Data Characteristics

The California Department of Health Services (CDHS) is designated by the United States Environmental Protection Agency (USEPA) to be the state agency that administers and enforces the requirements of the federal Safe Drinking Water Act. Public water systems are required to monitor and verify that the levels of contaminants present in water do not exceed maximum contaminant levels (MCLs), which are enforceable drinking water standards defined under the Safe Drinking Water Act. To date, MCLs have been established for 95 chemical and six radioactive contaminants. Generally, MCLs are set as close as is economically or technically feasible to levels below which there is no known or expected health risk.

CDHS submits quarterly data to the USEPA for inclusion into the Safe Drinking Water Information System (SDWIS). According to data available for 1999, the drinking water quality provided by 8,500 public water systems in California regulated by CDHS generally met all of the federal drinking water standards and was safe to drink. Over 99% of California's population served by public water systems received drinking water that satisfied all of the primary drinking water standards for organic and inorganic contaminants. About 98% of California's population served by public water systems received drinking water that met drinking water standards for bacteriological quality. About 99% of the state's population served by public water systems using surface water received drinking water that satisfied the filtration treatment and monitoring provisions for surface water treatment. Overall, the state has exceeded the Healthy People 2010 target of 95% of persons served by public water systems receiving drinking water that meets Safe Drinking Water Act regulations.

About 97–98% of California's population receives water service from public water systems, with the remaining 2–3% of the population receiving water for use in their homes from private domestic wells. CDHS does not monitor private domestic wells.

Since 1984, CDHS has maintained the Drinking Water Program's Water Quality Monitoring Database of chemicals and radionuclides in public drinking water sources. More than 20,000 of over 25,000 drinking water sources in the database currently provide water for public consumption to public water systems. Over 17,000 of these sources have been tested for at least one chemical between 1984 and 1998. Of these, 16% exceeded at least one primary MCL. The most serious drinking water contamination problems are found primarily in the San Joaquin Valley and the South Coast Region of the state. Current contaminants of concern include methyl tertiary-butyl ether (MTBE), perchlorate, and N-nitrosodimethylamine (NDMA).

## Data Limitations

Routine monitoring is conducted for less than 150 contaminants. Health-based regulations exist for even fewer chemicals, such as some of the disinfection by-products. In some cases, such as arsenic, the newer regulations are lowering the MCL to be more protective of public health.

Public water systems are required to conduct routine monitoring of regulated contaminants based on a schedule determined by a number of factors, including the type of water system, water source and vulnerability, and type of contaminant. For example, surface water sources are sampled annually, but ground water sources may only need to be sampled for organic chemicals every nine years if there were no exceedences during the first two years of sampling. More frequent sampling is required when detections or exceedences are found.

Although data entry into the water quality monitoring database has been increasing, data are still not available on all water sources in California. Also, data on microbial contamination are not maintained.

Currently no monitoring requirements exist for private wells; thus there are no standardized state-wide data available on private well water quality.

## Additional Information

**California Department of Health Services**
**Division of Drinking Water and**
**Environmental Management**
http://www.dhs.cahwnet.gov/ps/ddwem
http://www.dhs.cahwnet.gov/ps/ddwem/chemicals/chemindex.htm
601 North 7th Street
Sacramento, CA 95814
(916) 322-2308

**United States Environmental Protection Agency**
**Office of Ground Water and Drinking Water**
http://www.epa.gov/ogwdw/dwinfo/ca.htm
http://www.epa.gov/safewater
Ariel Rios Building
1200 Pennsylvania Avenue, NW
Washington, DC 20460-0003
(202) 564-3750

# Recreational Water Quality

## Definition

Percent of assessed rivers, lakes, and estuaries that are safe for fishing and recreational purposes.

## Formula

$$\text{Percent} = 100 \times \frac{\text{number of assessed rivers, lakes, and estuaries that are safe for fishing and recreational purposes}}{\text{total number of assessed rivers, lakes, and estuaries}}$$

## Significance

Rivers, lakes, and estuaries contaminated with chemicals or infectious substances can affect recreational and food production uses such as fish and shellfish harvesting. Personal use of contaminated waterbodies can result in exposures to infectious agents, such as bacteria or viruses, that may lead to acute health effects. Consuming fish or shellfish contaminated with biotoxins can cause acute health effects, or even death, and regularly consuming fish or shellfish contaminated with chemicals may lead to chronic health effects.

## Data Characteristics

Section 303(d) of the federal Clean Water Act requires the state to identify and prepare a list of waters that do not or are not expected to meet water quality standards after applying existing required controls, such as minimum sewage treatment technology. Table 1 shows the areal extent and number of water bodies assessed to date. In 1998, over 500 water bodies in California failed to meet applicable standards.[1] The state has prioritized most of these for developing specific total maximum daily load (TMDL) limits.[2] These limits define the amount of a specific pollutant a water body can tolerate on a daily basis and still meet water quality goals. Once the TMDL is determined, the regulatory agency allocates a portion of the load to each source of that pollutant within a particular watershed. Sources may include runoff from farming, animal husbandry, or industrial activities, as well as lawns and parking lots. Types of pollutants that pose concerns for water bodies include pesticides, metals, sediment, nutrients or low dissolved oxygen, bacteria and pathogens, and trash or debris. Figure 1 depicts the priority areas for California. Identifying water bodies of concern and implementing appropriate TMDL requirements are steps towards meeting the Healthy People 2010 objective of increasing the proportion of rivers, lakes, and estuaries that are safe for fishing and recreational purposes.

Fish consumption health advisories may be issued for bodies of water with fish contaminated by chemicals such as mercury or pesticides. Advisories provide specific information about how much fish or what kinds of fish caught from specific areas can be safely eaten. Fish health advisories are published in fishing regulation booklets distributed by the California Department of Fish and Game and may be posted at fishing sites. Currently, fish health advisories have been issued for areas within seven of the eight California fishing

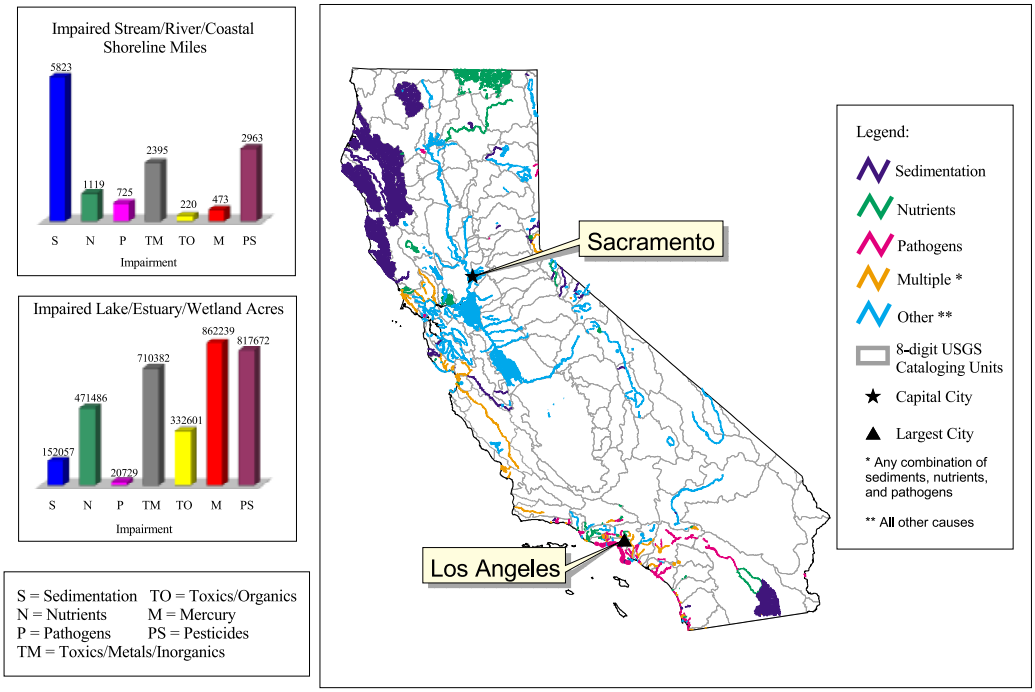
## Table 1. Water Body Coverage in the Water Body System (WBS) Database

| Water Body Type | Total Areal Extent in CA | Areal Extent of Assessed Water Bodies in WBS | No. of Water Bodies Assessed | Percent of Total Areal Extent Assessed |
|---|---|---|---|---|
| Bays and Harbors (acres) | Not Available | 471,429 | 50 | Not Available |
| Coastal Shoreline (miles) | 1,609* | 997 | 96 | 62 |
| Estuaries (acres) | Not Available | 827,784 | 48 | Not Available |
| Ground Water (sq. miles) | Not Available | 62,652 | 351 | Not Available |
| Lakes/Reservoirs (acres) | 1,672,684* | 754,737 | 299 | 45 |
| Ocean and Open Bay (acres) | Not Available | 316,794 | 25 | Not Available |
| Rivers/Streams (miles) | 211,513* | 25,274 | 715 | 12 |
| Saline Lakes (acres) | Not Available | 410,919 | 10 | Not Available |
| Wetlands, Freshwater (acres) | Not Available | 104,782 | 77 | Not Available |
| Wetlands, Tidal (acres) | Not Available | 114,679 | 9 | Not Available |

* Estimates obtained from the 1994 US EPA Reach File 3/Digital Line Graph data. Estimates were not updated for 2000. Lake estimates are for perennial and intermittent lakes.

Source: California State Water Resources Control Board.

**Figure 1. 1998 Polluted Waters.**




Source: United States Environmental Protection Agency.

districts. Warnings are also issued or quarantines established as needed for recreational and commercial shellfish harvesting. State staff work with local county and environmental health staff to disseminate warnings or quarantine notices.

State and local agencies test waters along public beaches for microbiological contaminants and advise the public of beach closures. In 1999, less than 2% of beaches located in the 10 coastal counties and the city of Long Beach that report to the state were closed or posted because of exceedences of state standards.

## Data Limitations

A variety of data bases that provide information on many aspects of recreational water quality are maintained by different state agencies. Much of this data is not available in formats that can be easily reviewed. Thus, it is difficult to judge the characteristics or limitations of the data. Coordination among different local, state, and federal agencies is needed before the percentage of assessed rivers, lakes, and estuaries that are safe for fishing and recreational purposes can be determined and the information can be disseminated.

## Additional Information

**California State Water Resources Control Board**
http://www.swrcb.ca.gov/news/index.html
1001 I Street
Sacramento, CA 95814
(916) 341-5250

**California Department of Water Resources**
http://www.dwr.water.ca.gov/
1416 9th Street, Room 1104-1
Sacramento, CA 95814
(916) 653-5791

**United States Environmental Protection Agency**
http://www.epa.gov/ow/
http://www.epa.gov/iwi/states/CA
http://www.epa.gov/region09/water/tmdl/index.html
http://www.epa.gov/owow/tmdl/states/ca.html
1200 Pennsylvania Avenue, NW
Washington, DC 20460

**Office of Environmental Health Hazard Assessment**
http://www.oehha.ca.gov/fish.html
http://www.oehha.ca.gov/fish/general/index.html
P.O. Box 4010
Sacramento, CA 95812-4010
(916) 324-7572

**California Department of Fish and Game**
http://www.dfg.ca.gov
1416 9th Street
Sacramento, CA 95814
(916) 445-0411

**California Department of Health Services**
**Preharvest Shellfish Protection and Marine Biotoxin Monitoring Program**
http://www.dhs.ca.gov/org/ps/ddwem/environmental/Shellfish/Shellfish.htm
(510) 540-3423

**California Department of Health Services**
**Environmental Management Branch**
http://www.dhs.ca.gov/org/ps/ddwem/environmental/embindex.htm
601 North 7th Street
Sacramento, CA 95814
(916) 445-0498

**California Department of Health Services**
http://www.dhs.cahwnet.gov/ps/ddwem/environmental/Rec_Health/Rechealth.htm
http://www.dhs.cahwnet.gov/ps/ddwem/beaches/beachesindex.htm
http://www.dhs.cahwnet.gov/ps/ddwem/beaches/ab411_1999report.htm

**Environmental Defense Scorecard**
http://www.scorecard.org/env-releases/water/cwa-state.tcl?fips_state_code=06#maps

## References

1. California State Water Resources Control Board. 1998 California water quality assessment report. August 1999.
2. Ruffolo, Jennifer. TMDLs — The revolution in water quality regulation. California Research Bureau, California State Library. April 1999.

# Hazardous Waste Sites

## Definition

The current number of sites in California on the United States Environmental Protection Agency's National Priorities List (NPL). NPL sites are also commonly referred to as Superfund sites. The NPL is intended to represent the country's most important hazardous waste sites requiring remediation.

## Formula

Current number of NPL sites = existing NPL sites + added NPL sites – removed NPL sites.

Proposed sites are evaluated using a hazard ranking system to assess the relative threat associated with the potential release of hazardous substances. The hazard scoring system considers the quantity, toxicity and potential exposure pathways of all chemicals at a site.

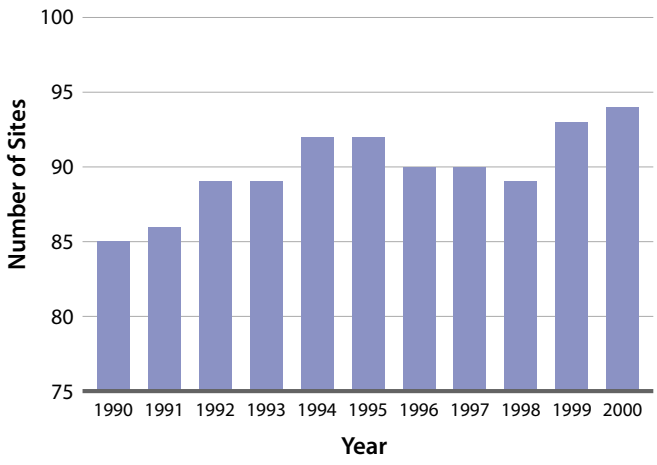
## Significance

The current number of NPL sites is a measure of progress towards cleaning up the most contaminated hazardous waste sites in the state. The cleanup process is designed to control threats to public health and the environment from uncontrolled releases of hazardous substances. The NPL program began with the Comprehensive Environmental Response, Compensation and Liability Act of 1980. Nationwide over 30,000 potential sites have received the first level of evaluation. Historically about 5–10% of all sites evaluated are eventually placed on the list. The most common types of waste at NPL sites include heavy metals, solvents, pesticides, and radioactive wastes. An NPL site can pose threats to ground and surface water, soil, or air.

## Data Characteristics

Figure 1 shows the number of sites per year in California from 1990 to 2000. The number of NPL sites increased over the past ten years, but remained relatively stable around 90. Very few sites are added or removed from the list in a given year. Figure 2 shows the number of sites in year 2000 by county. Santa Clara (23) and Los Angeles (14) Counties had, by far, the most sites. Almost half of all counties, most in the far north and eastern parts of California,

**Figure 1. Number of National Priorities List Sites, California, 1990-2000.**



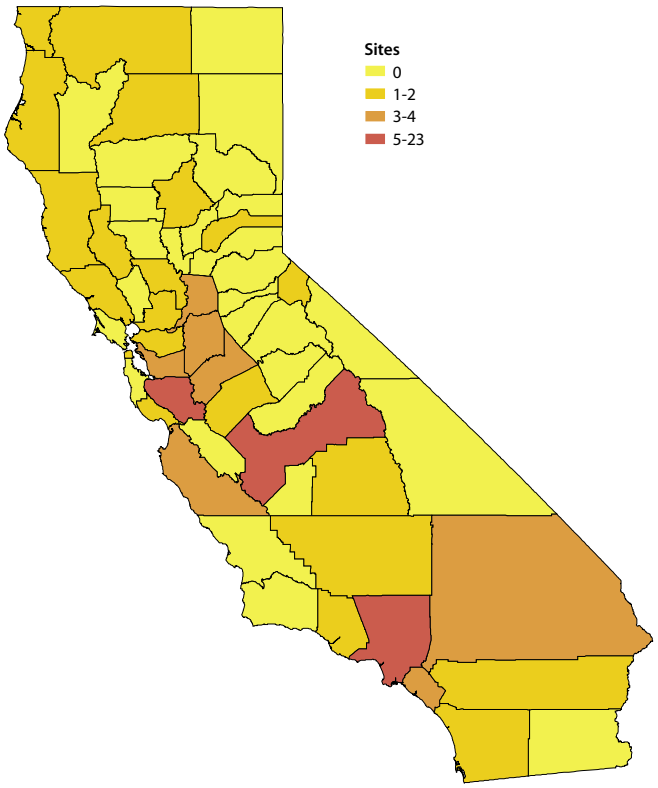

Source: Agency for Toxic Substances and Disease Registry.

do not have any current NPL sites. One Healthy People 2010 goal is to minimize the risks to human health and the environment posed by hazardous waste sites.

## Data Limitations

The number of NPL sites is a somewhat crude measure of progress because it does not include on-going cleanup activities. A site is only removed from the list after remediation is complete. The number of NPL sites also does not indicate the number of people potentially exposed to hazardous substances or the health risks associated with those substances. All NPL sites are not the same. Each site can have very different chemical contaminants and potential exposure pathways.

**Figure 2. Number of National Priorities List Sites, by County, 2000.**




Source: Agency for Toxic Substances and Disease Registry.

## Additional Information

**United States Environmental Protection Agency**
**Superfund Program**
http://www.epa.gov/superfund/sites/npl/ca.htm
75 Hawthorne Street
San Francisco, CA 94105
(415) 947-8021

**Agency for Toxic Substances and Disease Registry**
**HazDat Database**
http://www.atsdr.cdc.gov/gsql/siteact.script
1600 Clifton Road
Atlanta, GA 30333
(888) 422-8737

# Solid Waste

## Definition

Pounds per person per day of municipal solid waste disposed. Municipal solid waste is nonhazardous trash coming from homes, industries, and commercial and institutional offices. Waste disposed is the tons of waste actually going into landfills.

## Formula

$$\text{Pounds of waste per person per day} = \frac{\text{waste (tons/year)} \times 2{,}000}{\text{population} \times 365}$$

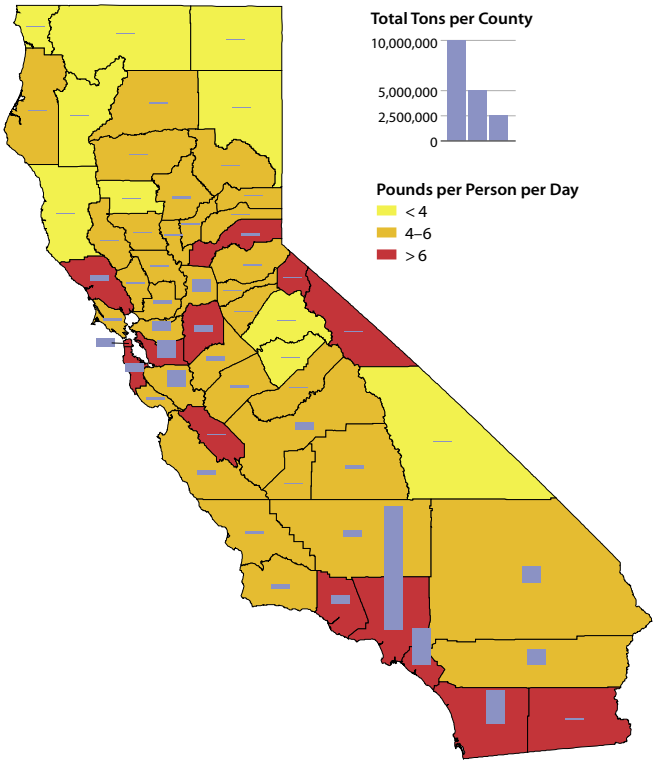
## Significance

Waste management is important for the health and well-being of a population. It is one of the major ways to improve living conditions, reduce pollution of water, and reduce exposure to toxins and pathogens in waste materials. Waste disposal is an indicator of resource depletion as well. The majority of municipal solid waste is paper and yard trimmings, with smaller amounts of metals, glass, plastics, food scraps, rubber, leather, textiles, and wood. Some other components (particularly batteries and household chemicals) potentially can be hazardous if disposed of improperly. Landfills are rapidly filling up and the focus has shifted to source reduction (waste prevention), diversion (recycling or composting), and development of new waste processing technologies.

## Data Characteristics

The California Integrated Waste Management Board (CIWMB) collects solid waste disposal data annually for each waste management jurisdiction. CIWMB tracks tons of waste each year in board-permitted landfills, transformation facilities, and exports. Figure I shows total tons per county and pounds per person per day of waste disposed in 1999. The numbers reflect true differences in rates of waste disposal. However, differences may be affected by various factors. For example, counties with a less developed recycling system (less diversion) or that have more industry/

**Figure 1. Municipal Solid Waste Disposal, Total Tons Per County, and Pounds Per Person Per Day, by County, 1999.**

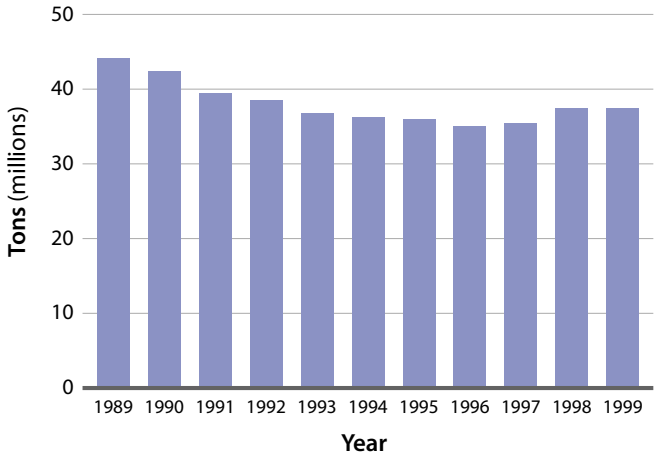



Source: California Integrated Waste Management Board.

business (increased generation) may have higher rates of waste disposal.

Figure 2 shows total statewide disposal from 1989–1999. The amount of waste disposed in the state each year went down in the early- and mid-1990s. Disposal has increased in recent years, but is still less than the amount ten years ago. Although estimated statewide generation has grown, disposal has declined because of increased recycling.

**Figure 2. Total Reported Municipal Solid Waste Disposed, California, 1989-1999.**




Source: California Integrated Waste Management Board.

More recycling is one of the Healthy People 2010 goals. California reuses and recycles approximately 42% of its solid waste. The baseline national rate is 27% and the target is 38%.

## Data Limitations

CIWMB counts what is reported and legally dumped. The measure of pounds per person per day does not assess individual waste generation or exposure to waste. The indicator does not take into account the source or composition of the waste, which may impact health differently. Hazardous waste is not included in this measure.

## Additional Information

**California Integrated Waste Management Board**
http://www.ciwmb.ca.gov/
1001 I Street
P.O. Box 4025
Sacramento, CA 95812-4025
(916) 341-6000

**United States Environmental Protection Agency**
**Topic: Wastes**
http://www.epa.gov/ebtpages/wastes.html

**Office of Solid Waste**
http://www.epa.gov/osw
1200 Pennsylvania Avenue, NW
Washington, DC 20460

# Cancer and the Environment

## Definition

The extent of cancer occurrence is most commonly determined by two measures:

**Cancer Incidence:** The rate of newly diagnosed cancer cases in a given time period (usually one year) and area

**Cancer Mortality:** The rate of deaths due to cancer in a given time period and area

## Formula

$$\text{Incidence} = 100{,}000 \times \frac{\text{newly diagnosed cancer cases in a given time period and area}}{\text{total population in area}}$$

$$\text{Mortality} = 100{,}000 \times \frac{\text{number of deaths due to cancer in a given time period and area}}{\text{total population in area}}$$

## Significance

Cancer is the second leading cause of death in the United States. Annually, more than 120,000 people in California are diagnosed with some form of invasive cancer, not including the common skin cancers, and approximately 50,000 Californians die each year from cancer.[1]

Although the specific cause of cancer is unknown, it is thought that some combination of genetic and environmental factors play a role in the development of the disease. Among the known risk factors for cancer are smoking and high fat diets. In addition, certain industrial chemicals used in manufacturing have been found to be carcinogenic; occupational exposures are thought to account for about 5% of cancer deaths. Residents of communities where cancer clusters occur are often concerned about their physical environment. Although there has been much speculation about physical environment as a risk factor for cancer, most geographic differences in cancer incidence appear to result more from physical differences in people than differences in environment. Moreover, cancer is common enough that multiple cases and types in a neighborhood may not be unusual. While responding to community concerns about cancer is important, most investigations of perceived excess cancer rates fail to confirm them. Those investigations that do find an excess of cancer cases are usually unable to identify an environmental cause. Thus, the most important response by a health department to requests for investigations is a step-wise approach that may include talking with community members, reviewing characteristics of reported cases and exposure data, and determining if a cluster actually exists depending upon what each step reveals.

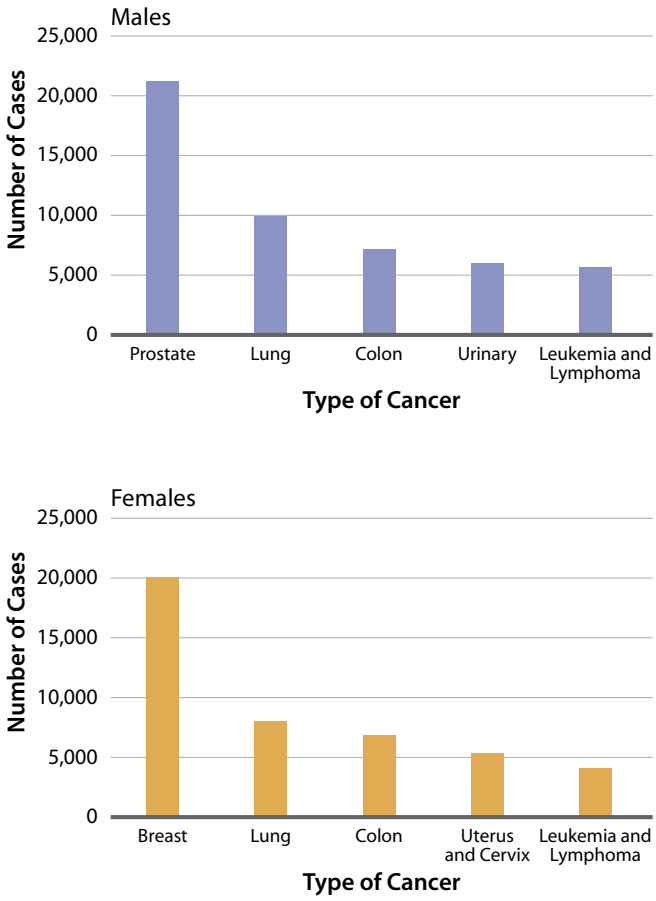
## Data Characteristics

Since 1988, hospitals in California have been required to report all newly diagnosed cancer cases to one of 10 regional cancer registries in the state. Information on the demographics and characteristics of each case is reported to the registry. This information

is compiled and used by the statewide California Cancer Registry (CCR) for research on cancer causes and prevention. Figure 1 shows the expected number of common cancer cases in California by gender for the year 2000.

One of the Healthy People 2010 goals is to "reduce the overall cancer death rate." The target rate is 159.9 deaths per 100,000 people. In 1997, the cancer mortality rate in California was 146.5, already below this goal.[1] During 1993–1997, the average annual cancer incidence rate in California was 378.[1]

**Figure 1. Expected Number of Common Cancer Cases, California, 2000.**




Source: American Cancer Society and California Department of Health Services, California Cancer Registry.

## Data Limitations

While the CCR information on the number of new cancer cases per year is accurate and reliable, detailed information on risk factors and exposures at the individual level are not available for the cases.

## Additional Information

**California Department of Health Services**
**California Cancer Registry**
http://www.ccrcal.org/
1700 Tribute Road, Suite 100
Sacramento, CA 95815-4405
(916) 779-0300

**The American Cancer Society**
http://www.cancer.org/
(800) ACS-2345

**National Cancer Institute Cancer Information**
http://www.cancer.gov/cancer_information/
Suite 3036A
6I16 Executive Boulevard
MSC 8322
Bethesda, MD 20892-8322
(800) 422-6237

## References

1. Morris CR, Cohen R, Perkins CI, Allen M, Schlag R, Wright WE. Cancer in California: 1988–1997. Sacramento, CA: California Department of Health Services, Cancer Surveillance Section: June 2000.

# Childhood Asthma

## Definition

Asthma is a complex illness that is influenced by environmental, genetic, immunologic, and socioeconomic factors. Asthma is characterized by chronic inflammation and periodic obstruction of the airways that can lead to difficulties in breathing. Asthmatic symptoms include wheezing, shortness of breath, tight chest, and cough.

## Formula

$$\text{Rate} = \frac{\text{number of asthma hospitalizations, children age 0–14}}{\text{100,000 children age 0–14}}$$

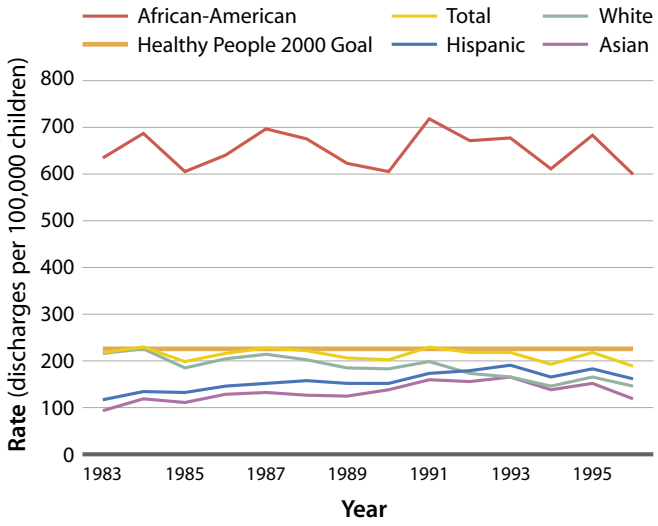
## Significance

Asthma can be seen as an environmental health indicator because certain air pollutants, such as ozone, nitrogen oxides, and particulate matter, can aggravate the disease in those suffering from asthma. Indoor air pollutants, such as tobacco smoke, and allergens from pet dander, house dust mites, cockroaches, and molds can trigger this illness.

## Data Characteristics

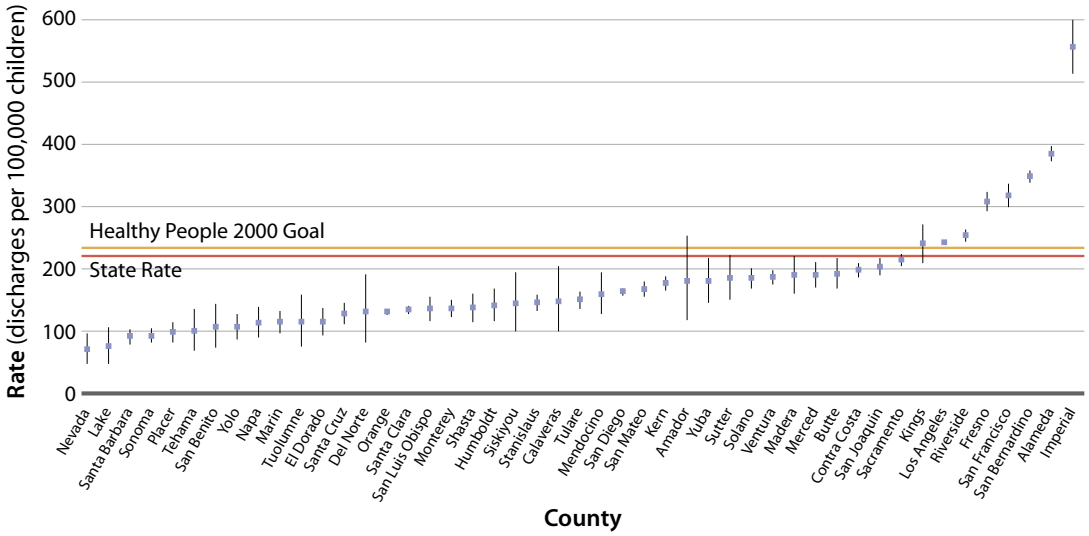
Based on national estimates, up to 2.3 million Californians have asthma.[1] Asthma is the most common chronic disease in children both in California and nationwide. Over 600 people die from asthma each year in California. The Office of Statewide Health Planning and Development maintains a database of all hospital admissions for asthma in California. Among children, hospitalization rates have decreased among Whites, but increased for Asians and Hispanics (Figure 1). African-American children have had asthma hospitalization rates that are four times higher than those of White children. Rates of childhood asthma hospitalizations vary greatly by county, with Imperial, Alameda, San Bernardino, San Francisco, and Fresno Counties showing the highest rates using data from 1995–1997 (Figure 2).

**Figure 1. Age-adjusted* Asthma Hospitalization Rates in Children Age 14 and Under, by Race and Ethnicity, California, 1983-1996.**




* Age-adjusted to the 1990 California population.
Source: California Office of Statewide Health Planning and Development.

**Figure 2. Age-adjusted* Asthma Hospitalization Rates in Children Age 14 and Under, by County, California, 1995-1997.**




* Age-adjusted to the 1990 California population. Counties with less than 20 cases not shown.
Source: California Office of Statewide Health Planning and Development.

One of the Healthy People 2010 goals is to "reduce hospitalizations for asthma." Among children under five years of age, the goal is 25 hospital admissions per 10,000. In 1998, the rate in California was 27.9, just above the Healthy People 2010 goal.

## Data Limitations

Complete statewide data exist only for hospital admissions or deaths. However, hospitalization for asthma only occurs in the most serious cases, and is not a measure of the true prevalence of asthma. The capacity to monitor changes in the prevalence and incidence of asthma in California is extremely limited.

## Additional Information

**Office of Statewide Health Planning and Development**
http://www.oshpd.cahwnet.gov/
818 K Street, Room 500
Sacramento, CA 95814
(916) 322-2814

**Global Initiative for Asthma**
http://www.ginasthma.com/

**National Heart, Lung, and Blood Institute**
http://www.nhlbi.nih.gov/

**American Lung Association**
http://www.lungusa.org/asthma/
1740 Broadway
New York, NY 10019
(212) 315-8700

**American Lung Association of California**
http://www.californialung.org/support/asthma.html
424 Pendleton Way
Oakland, CA 94621
(510) 638-LUNG

**Asthma and Allergy Foundation of America**
http://www.aafa.org/
1233 20th Street, NW, Suite 402
Washington, DC 20036
(202) 466-7643

**California Department of Health Services**
**Environmental Health Investigations Branch**
http://www.dhs.ca.gov/ehib/
1515 Clay Street, Suite 1700
Oakland, CA 94612
(510) 622-4500

## References

1. Centers for Disease Control and Prevention. Forecasted state-specific estimates of self-reported asthma prevalence-United States, 1998. MMWR 1998;47:1022–25.

# Childhood Lead Poisoning

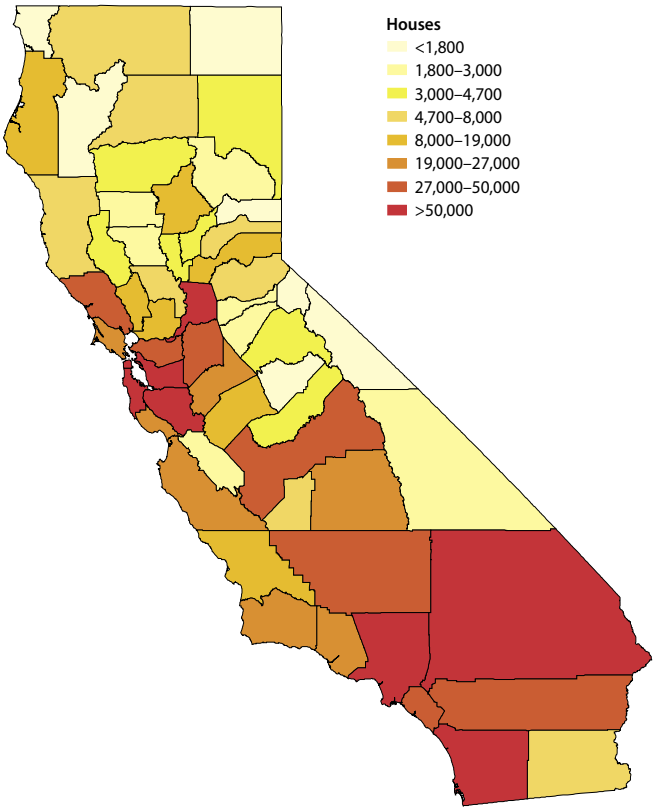
## Definition

A child with a single venous blood lead level (BLL) of 20 micrograms per deciliter (µg/dL) or greater, or two BLLs of 15 µg/dL or greater, drawn at least 30 days apart meets the case definition of lead poisoning. However, BLLs greater than or equal to ten µg/dL are considered elevated and warrant concern.

## Significance

Lead poisoning is a significant problem among children in the United States. The Centers for Disease Control and Prevention (CDC) estimates that 1.7 million children age five or younger may be affected by lead poisoning. The major sources of exposure include leaded paint in older homes, soil contaminated with lead from paint, and past emissions of leaded gasoline. Although leaded paint has been outlawed for a number of years, older homes are still a potential source of exposure (see Figure 1 for the number of pre-1950 houses in California in 1990). According to the United States Environmental Protection Agency, more than 80% of homes built before 1978 contain leaded paint. Young children are at highest risk because of greater hand-to-mouth activity and because their nervous systems are still developing. Lead poisoning can affect virtually all systems in the body and has been associated with learning disabilities, mental retardation, and even death at high exposure levels.

**Figure 1. Number of Pre-1950 Houses, by County, 1990.**




Source: United States Census Bureau.

## Data Characteristics

Currently, the California Childhood Lead Poisoning Prevention Branch (CLPPB) of the California Department of Health Services receives information on children with elevated BLLs. Current regulations only require laboratories to report BLLs of 25 µg/dL or higher, although CDC currently describes the level of concern as 10 µg/dL. Laboratories

have been requested to voluntarily report all values greater than or equal to 15 μg/dL, and a number of labs now report all BLLs. State regulations require that medical providers screen children served by publicly funded programs at 12 and 24 months of age. It is estimated that approximately 20% of children in these programs are currently being tested for elevated lead levels. In 1998, 912 cases of childhood lead poisoning were reported to CLPPB. In 1999, 852 cases were reported.

The Healthy People 2010 goal is to have no children with blood lead levels exceeding 10 μg/dL. Nationally, between 1991–1994, 4.4% of children had blood lead levels that exceeded this standard.[1]

## Data Limitations

A major limitation of data collected by CLPPB is that only incomplete information about the number of children tested is available. The lack of denominator information prevents the estimation of overall prevalence of lead poisoning in California. In addition, because laboratories are required only to report levels greater than or equal to 25 μg/dL, which is well above the CDC level of concern, there is underreporting of children with elevated BLLs. CLPPB is now using data from several laboratories that have reported all BLLs over a period of years to monitor prevelence trends.

## Additional Information

**California Department of Health Services**
**Lead Poisoning Prevention Branch**
http://www.dhs.ca.gov/childlead
1515 Clay Street, Suite 1801
Oakland, CA 94612
(510) 622-5000

**Centers for Disease Control and Prevention**
http://www.cdc.gov/nceh/lead/lead.htm
http://www2.cdc.gov/nceh/lead/census90/housell/housell.htm

**United States Environmental Protection Agency**
http://www.epa.gov/opptintr/lead/index.html
1200 Pennsylvania Avenue, NW, Mailcode 7404
Washington, DC 20460

## References

1. National Center for Healthy Statistics. The National Health and Nutrition Examination Survey III.

# Low Birth Weight

## Definition

The term low birth weight applies to babies who weigh less than 2,500 grams (5.5 pounds) at birth.

## Formula

$$\text{Percent low birth weight} = 100 \times \frac{\text{number of babies less than 2,500 grams born in a given time period}}{\text{All babies born in that time period}}$$

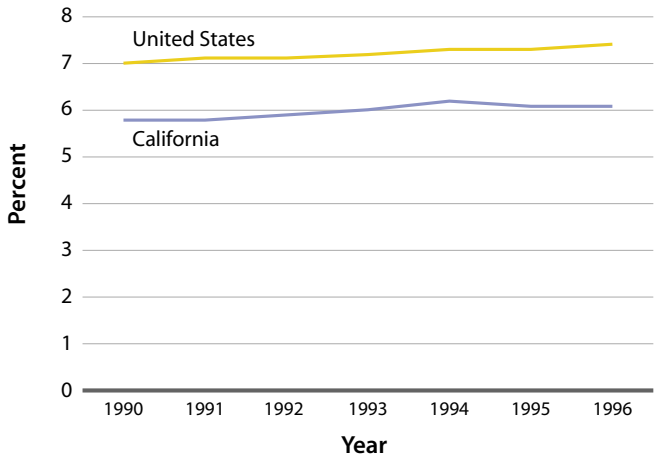
## Significance

Low birth weight is commonly used as an indicator of the general health of a population. Low birth weight babies are several times more likely to die within the first month of life compared with babies who are of normal weight. Low birth weight can lead to developmental problems in areas such as learning disabilities and motor skills. In addition, babies with low birth weight are more likely to develop conditions such as epilepsy, cerebral palsy, and mental illness. Potential contributors to low birth weight include poor nutrition, inadequate prenatal care or lack of access to care, low socioeconomic status, and poor environmental conditions. Although the environmental causes of low birth weight are still being studied and debated, among the factors that have been found to be associated with low birth weight are maternal smoking and maternal exposure to diethylstilbestrol (DES).

## Data Characteristics

From 1990–1996, the percent of infants with low birth weight in California increased slightly from 5.8 to 6.1 (Figure 1). Nationwide, the percentage of low birth weight babies born during this time was higher, ranging from 7 to 7.6. The Healthy People 2010 goal is to reduce low birth weight babies born in the United States to 5%.

**Figure 1. Percent Low Birth Weight Infants, California and the United States, 1990-1996.**




Source: California Department of Health Services, Maternal and Child Health Branch.

## Data Limitations

Birth weight data are available from birth certificates. A disadvantage of using birth certificates in California is their lack of detailed information on potential maternal risk factors for low birth weight, such as cigarette smoking.

## Additional Information

**California Department of Health Services**
**Maternal and Child Health Branch**
http://www.mch.dhs.ca.gov/
714 P Street, Room 750
Sacramento, CA 95814
(916) 657-1347

**Centers for Disease Control and Prevention**
**National Center for Health Statistics**
http://www.cdc.gov/nchs/
6525 Belcrest Road
Hyattsville, MD 20782-2003
(301) 458-4636

**Centers for Disease Control and Prevention**
**Reproductive Health Information Source**
http://www.cdc.gov/nccdphp/drh/
4770 Buford Highway, NE
Mailstop K20
Atlanta, GA 30341-3717
(770) 488-5200

**American College of Nurse-Midwives**
http://www.midwife.org/
818 Connecticut Avenue, NW, Suite 900
Washington, DC 20006
(202) 728-9860

**American College of Obstetricians and Gynecologists**
http://www.acog.org/
409 12th Street, SW
P.O. Box 96920
Washington, DC 20090-6920

# Infant Mortality

## Definition

The term infant mortality refers to deaths in the population under one year of age.

## Formula

$$\text{Rate} = \frac{\text{number of deaths among children under one year of age}}{\text{1,000 live births}}$$

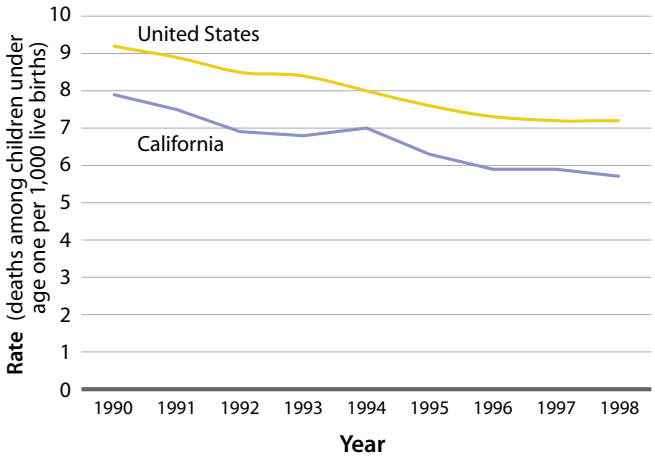
## Significance

Infant mortality rates reflect the overall quality of life, environmental conditions, and accessibility to health care in a community. Since children are often more vulnerable to the toxic effects of environmental exposures, significant changes in the infant mortality rate signal the need for further investigation. There are a number of risk factors correlated with infant mortality including low birth weight, poverty, birth to a teenaged parent, air pollution, and cigarette smoking. The major causes of infant death are sudden infant death syndrome (SIDS), birth defects, unsafe housing, and inadequate supervision.

## Data Characteristics

During 1990–1998, the infant mortality rate in California declined from 7.9 to 5.7, a 28% decrease (Figure 1). This reflects a similar trend for the United States as a whole. Nationwide, the infant mortality rate dropped during this time from 9.2 to 7.2, a 22% decrease. The Healthy People 2010 target is to reduce the national infant mortality rate to 4.5. If California's infant mortality rate continues to decrease at the current rate, this target will be met.

**Figure 1. Infant Mortality Rate, California and the United States, 1990-1998.**




Source: California Department of Health Services, Maternal and Child Health Branch.

## Data Limitations

Data on infant births and deaths are available from birth and death certificates. A disadvantage of using these documents is their lack of detailed information on potential maternal risk factors for infant mortality.

## Additional Information

**California Department of Health Services**
**Maternal and Child Health Branch**
http://www.mch.dhs.ca.gov/
714 P Street, Room 750
Sacramento, CA 95814
(916) 657-1347

**Health Resources and Services Administration**
http://www.ask.hrsa.gov
(888) 275-4772

# California/Baja California Border Region: Air Quality

## Definition

The California/Baja California region is defined as the area that is 100 kilometers (62.5 miles) of each side of the international border. This area includes San Diego and Imperial Counties in California and the Mexican municipalities of Tijuana, Tecate, and Mexicali in Baja California. The border region is characterized by rapid population growth, water scarcity, and environmental degradation. Particulate matter and ozone are two air pollutants that exceed air quality standards in the border region.

## Formula

Maximum annual values of particulate matter (less than 10 microns in diameter) ($PM_{10}$) and ozone.

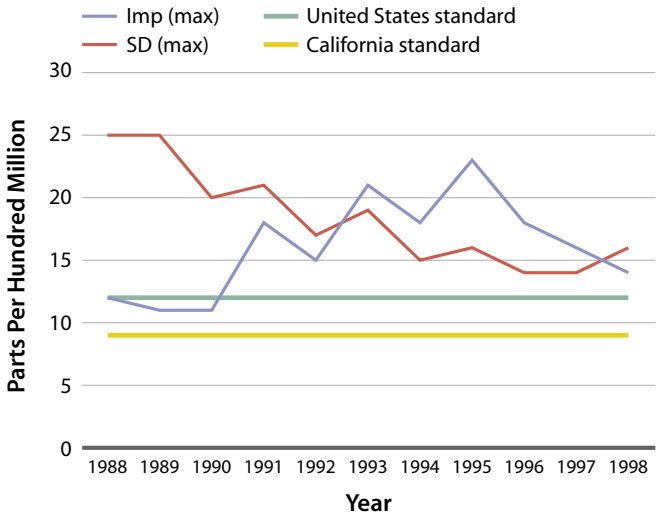
## Significance

Imperial County, Mexicali, and Tijuana all exceed U.S. and Mexican air quality standards for $PM_{10}$. San Diego County, Imperial County, and Mexicali exceed their respective country standards for ozone. Both of these pollutants are of public health concern and are important environmental health indicators because they are known to trigger asthmatic symptoms in susceptible individuals.

## Data Characteristics

At the San Diego County ports of entry there are five to six million legal northbound crossings per month.[1] At the Calexico/Mexicali crossing in the Imperial Valley, diesel truck crossings increased 44% from 1991–1995.[2] Long wait and idling times at the border have contributed to the burden on the regional airshed. Other sources of poor air quality include region-wide traffic, industrial sources, open burning, and agricultural dust. Although the two California border counties continue to exceed California and U.S. standards for ozone, ambient ozone has decreased 36% from 1988 to 1998 in San Diego County, while increasing 17% in Imperial County over the same time period (although recently starting to decline) (Figure 1). Maximum particulate

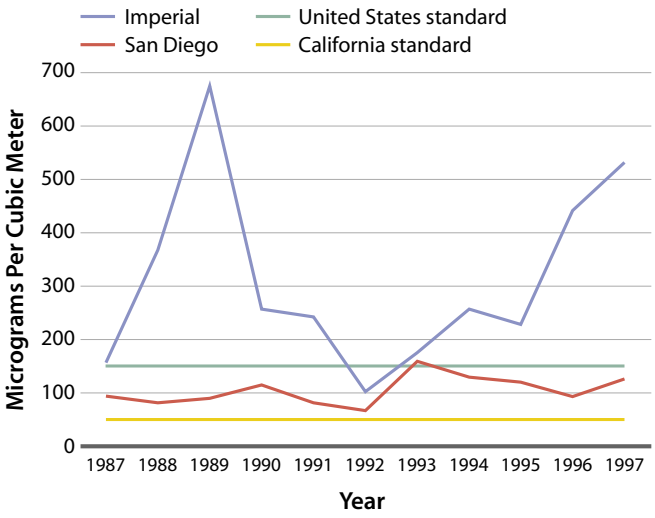
**Figure 1. Maximum Values of Ambient Ozone, California Border Counties, 1988-1998.**




Source: California Air Resources Board.

matter levels are over three times higher in 1997 than in 1987 in Imperial County and up to four times higher on average over the time period than in San Diego County (Figure 2). Maximum particulate matter values also increased in San Diego County — they were 33% higher in 1997 than 1987. (No trend data are available for Tijuana and Mexicali).

**Figure 2. Maximum Values of 24-hr Average PM10 Levels, California Border Counties, 1987-1997.**




Source: California Air Resources Board.

## Data Limitations

Levels of maximum values of pollutants are used for regulatory purposes but do not reflect chronic exposures of high pollutant levels. In addition, high levels may be found in one part of a county or municipality but may not characterize the entire region accurately.

## Additional Information

**CICA: U.S./Mexico Border Information Center On Air Pollution**
http://www.epa.gov/ttn/catc/cica/
U.S Environmental Protection Agency
Research Triangle Park, NC 27711
(919) 541-0800

**Border Eco Web**
http://www.borderecoweb.sdsu.edu/
Institute for Regional Studies of the Californias
San Diego State University
5500 Campanile Drive
San Diego, CA 92182-4403
(619) 594-5423

**United States-Mexico Border Environmental Indicators 1997**
http://www.epa.gov/usmexicoborder/indica97/cover.htm
United States Environmental Protection Agency, Region 9
75 Hawthorne Street
San Francisco, CA 94105
(415) 947-8021

**California Air Resources Board**
http://www.arb.ca.gov
1001 I Street
P.O. Box 2815
Sacramento, CA 95812-2815
(916) 322-2990

## References

1. San Diego Dialogue. Who crosses the border: a view of the San Diego/Tijuana metropolitan region. April 1994.
2. Sweedler A, Ganster P. Sources of air pollution along the border: analysis of data, databases, and information. Final report. San Diego, CA: Southwest Center for Environmental Research and Policy:1997.

# California/Baja California Border Region: Rate of Diarrheal Morbidity

## Definition

The rate of three reportable infectious diseases that have diarrheal symptoms (Amebiasis, Salmonellosis, and Shigellosis) in the border region of California/Baja California.

## Formula

$$\text{Rate} = \frac{\text{number of new cases}}{\text{100,000 population}}$$

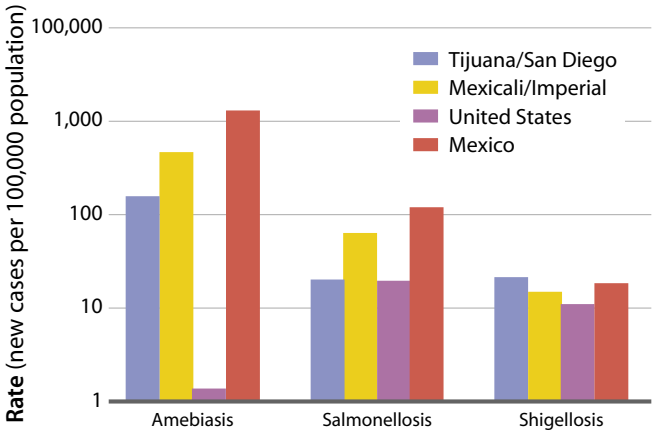
## Significance

Elevated rates of these three illnesses represent contact with contaminated persons, water, or food, and are a good indicator of environmental health because high rates occur in areas of poor sanitation and crowding.

## Data Characteristics

In general, rates of the three illnesses with diarrheal symptoms are higher in the border area than they are in the United States as a whole, but not as high as the rest of Mexico (Figure 1). The rate of Amebiasis, which is an infection with a protozoan parasite, has the highest rates of the three diseases at the border, but is rare elsewhere in the United States. This illness is high in areas with poor sanitation, and is transmitted mainly through contaminated water in epidemics. Salmonellosis, the next most common disease of the three, is a bacterial illness that is transmitted by infected food, from person to person, and from contamination of public water supplies. Shigellosis is another bacterial disease that can be transmitted by contaminated food, persons, or water. Epidemics of Shigellosis are common in areas of poor sanitation and crowding.

**Figure 1. Rate of Diarrheal Morbidity, California/Baja California Border Region, 1989-1991.**




Source: Pan Amercian Health Organization.

## Data Limitations

Many of these illnesses, although reportable to state health authorities, are missed because individuals do not seek medical care, there is a failure of the reporting system, or there are cases that are asymptomatic. Although an elevated rate or epidemics of these diseases may

be correlated with poor sanitation, they may be limited to a localized problem with food contamination and may not be directly linked to environmental pollution.

## Additional Information

**Centers for Disease Control and Prevention**
http://www.cdc.gov/health/
(800) 311-3435

**California Office of Binational Border Health**
http://www.dhs.ca.gov/ps/
3851 Rosecrans Street
P.O. Box 85524
San Diego, CA 92138
(619) 692-8472

**Pan American Health Organization**
http://www.fep.paho.org/
El Paso Field Office
US-Mexico Border
5400 Suncrest Drive, Suite C-4
El Paso, TX 79912
(915) 845-5950

## Closing Note From the Authors

We hope that readers have found this report easy to use and informative. One of our goals was to create a generally non-technical resource and educational device for the people of California. We have endeavored to present environmental health indicators that are relevant to Californians. However, we acknowledge that there will be differences of opinion about our indicator choices.

A related issue is whether our chosen indicators, when used together, are sufficient to form an impression of California's overall environmental health. We do not intend for this list of indicators to be static. As new threats to human health emerge, as new data become available, and as we receive recommendations from community organizations, we plan to add indicators to most accurately present a picture of the current state of environmental health in California.

Finally, we hope that our discussions of data limitations remind readers that the process of scrutiny is important when using environmental health data. With this awareness, readers may become more critical users of that type of information in the future.

## About the Environmental Health Investigations Branch

The mission of the Environmental Health Investigations Branch (EHIB) is to identify and work toward controlling harmful environmental factors, and to promote those things that are helpful. To accomplish this, the Branch:

- Conducts health and exposure investigations
- Undertakes health and exposure surveillance
- Provides public health oversight, technical assistance and training
- Facilitates public participation and effective community relations
- Develops policy initiatives and recommendations
- Maintains scientific preparedness

More information about EHIB is available on its website www.dhs.ca.gov/ehib/ or can be obtained by using the contact information listed below.

Environmental Health Investigations Branch
1515 Clay Street, Suite 1700
Oakland, CA 94612
(510) 622-4500
e-mail: EnvHInd@dhs.ca.gov

We would appreciate your feedback on the environmental health indicators we have selected for California. If you have ideas for more appropriate indicators to be included in future issues or suggestions to improve other content areas of this document, please send your comments to the e-mail or postal address listed above.